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Centre for Frontier Engineering Research (UNIV. OF ALBERTA)

Final Report

Networking Program for Arctic and Offshore Energy Development

February 1987
Project 84-04

Centre for Frontier Engineering Research

Networking Program for Arctic and Offshore Energy Development

(Requisition Number 23440-3-9212; Serial Number OST83-00427)

Final Report
March 1984 to March 1987

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Centre for Frontier Engineering Research

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Arctic and Offshore Energy Development

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Executive Summary

The Centre for Frontier Engineering Research (C-FER) was established in late 1983 to undertake research related to offshore structures and downhole tubular systems. Supported by industry, governments and universities, the Centre is currently located on the University of Alberta campus. In addition to support for research is a commitment by C-FER's constituent groups for a program of technology transfer. C-FER is therefore charged with a two-fold mandate: research and networking.

The Canada Centre for Mineral and Energy Technology, Energy, Mines and Resources Canada undertook suppport of a substantial segment of C-FER's networking activities for an initial three-year period. This report summarizes activities during that period and highlights future directions for the network.

The program of person-to-person industry contacts has proven to be a successful foundation on which to build the network. Continued emphasis will be placed on this activity. A suite of newsletters has been developed to supplement this direct contact. Both *Frontiers* and *Networker* have been well received by network contacts and have proven useful tools in the dissemination of both in-house and external information. Workshops have also played an important part in C-FER's networking activities. Small, participant-led sessions focussed on specific problems have drawn well, as has the seminar series on information resources. In addition, plans are underway for expert-led workshops of a more international flavour. C-FER's role in the field of information services has evolved into that of a facilitator, linking the end user with a problem to the appropriate information centre for the answer. Various other networking activities are also highlighted.

The establishment of a network has been an interesting and challenging experience. The continued success of the network depends upon its ability to evolve as changing industry needs demand, and on the continued recognition by C-FER Members of the important role that networking plays in C-FER's overall operation.

Centre des Recherches en Génie des Régions Frontières

Programme de Développement d'un Réseau d'Information sur le Développement de l'Énergie dans l'Arctique et les Régions Frontières

Rapport Final
Mars 1984 - Mars 1987

Résumé de l'Executif

Le centre de recherches en génie des régions frontières (C-FER) fut établi vers la fin de 1983 pour effectuer des recherches relatives aux constructions dans les régions frontières et aux systèmes tubulaires des puits. Ce centre, appuyé par le secteur industriel, des gouvernements et des universités, se trouve présentement sur le campus de l'Université de l'Alberta. En plus d'appuyer les projets de recherche, les groups membres du programme du C-FER se sont mis à établir un programme de correspondance en technologie. Le C-FER a donc été confié un double mandat: à savoir, de se charger des projets de recherche et de développer un réseau d'information.

Le centre Canadien de la technologie des minéraux et de l'énergie, divisions du département energie, mines et ressources Canada, s'est engagé à appuyer une partie importante des activités relatives au développement du reseau pour les premiers trois ans du programme. Le présent rapport fournit un résumé des activités de cette première stade et présente un apercu des orientations futures du réseau.

Le programme de communication directe entre members de l'industrie est une fondation importante sur laquelle on peut élaborer le réseau. On continuera à accorder une importance particulière à cette activité. Une suite de comminiqués a été développée comme supplément à cette communication directe. Les bulletins *Frontiers* et *Networker* ont reçue un acceuil favorable par les membres et se sont avérés des instruments efficaces pour la transmission d'informations provenant de sources internes et externes. Des ateliers ont aussi joué un rôle important dans le programme et les activités du réseau. Les petits réunions addressant des questions particulières et dirigées par des participants du réseau ont bien réussi, ainsi que les séries de conférences sur les ressources d'information. De plus, on commence à mettre sur pied des ateliers de caractère plus international, dirigés par des spécialistes du domaine. Le rôle du C-FER vis-àvis le domaine du service d'information a évolué en un genre de trait d'union liant l'utilisateur aven un probleme avec le centre d'information approprié qui pourrait lui aider. Plusieurs des autres activités du réseau sont aussi soulignées.

La mise au point d'un réseau d'information a été une expérience intéressante et un defi. Le succès continu du réseau repose sur sa capacité d'évoluer selon les exigences toujours changeantes des industres, ainsi que de la reconnaissance, par les membres, du rôle important joue par le programme de communication dans l'opération général du C-FER.

Centre for Frontier Engineering Research

Networking Program for
Arctic and Offshore Energy Development

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1.0 Introduction

In the early 1980's, representatives of Canada's steel industry approached the Faculty of Engineering at the University of Alberta to discuss the initiation of research related to the development of Arctic and offshore energy resources. Extensive dialogue followed with these and other interested groups and, by 1983, the concept of a research centre supported by industry, governments and universities had evolved. The result was the establishment of C-FER, the Centre for Frontier Engineering Research, an incorporated, non-profit research organization located on the University of Alberta campus.

From the earliest stages of C-FER's development, it was recognized that in addition to research (the creation of new knowledge), there was a role for the collaborative Centre to play in networking (the dissemination of existing knowledge). As the Centre took on form and substance, networking was included as an integral part of the overall mandate.

Of the many supporters of the networking initiative, one of the strongest was the Canada Centre for Mineral and Energy Technology within Energy, Mines and Resources Canada. It undertook direct support of these activities through a three-year contract underwriting slightly more than forty percent of staff, travel and support costs. The contract (Requisition Number 23440-3-9212; Serial Number OST83-00427) was established for the period of March 1984 to March 1987. Following the terms of that contract, specific activities of the C-FER network have been described on a regular basis. Further, the

Phase I Progress Report (submitted in November 1985) dealt in some detail with the process of moving the network from concept to reality. This report will augment that major effort with an overview of activities of the entire three-year contract period.

2.0 Goals and Activities

Three major goals were developed at the beginning of the networking program: 1) from a national perspective, to help Canadian industry be more competitive by making technology more accessible; 2) at the industry level, to act as a focal point and clearinghouse for information and to provide an independent assessment of knowledge gaps; and 3) for C-FER, to use the network as a listening post and thereby keep the Centre's own research on target.

From the outset, activities of the network have been split into four main areas: client contacts; workshops and seminars; publications and public relations; and information services. The success of the network has come, in large measure, from the integration of these various tasks. For purposes of this report, however, the four initiatives will be dealt with separately. An additional section will review a variety of other networking activities which do not fit "neatly" within one of the four main activity areas.

At the end of Phase I of the EMR contract, an audit of activities took place with a panel of reviewers representing C-FER Member organizations. It was the strong and unanimous view of the audit review team that the mandate defined for the network was well conceived and, further, that the activities undertaken to fulfill the goals and objectives were, in large measure, on target. Constructive suggestions for the future direction of the network were

made at the audit and are reflected in this report. (A list of those on the review team is included in Appendix A.)

While accountability for the networking program remained with CANMET until the end of the EMR contract period, the C-FER Board of Directors expressed interest in more closely monitoring the activities of the program. As a result, the Board Membership Committee was expanded to the Membership and Networking Committee in June 1986. Shortly thereafter, an internal review of networking activities took place. Results of that evaluative process are also reflected in this report. (Names of those on the Board Membership and Networking Committee may also be found in Appendix A.)

3.0 Client Contacts

The cornerstone of the C-FER network has always been that it is made up of individuals, not organizations. Face-to-face contact with network members was judged to be critical in order to demonstrate that C-FER has an interest in the capabilities of network members, their operations and their problems.

A major task of the network team during the first months of C-FER's operation was the establishment of a core of network contacts in the many industries involved in Canada's Arctic and offshore energy development. Designers, fabricators, welders, shipbuilders, contractors, government regulators and university researchers right across Canada were visited personally by the Networking Officer. Of all the "building" activities of the network, this has required the greatest effort and the greatest expense. It has also paid the greatest dividends. Personal contact with key individuals has enabled C-FER to explain

its mission and also to discover as much as possible about the many organizations and their perceptions of industry needs. Direct access to the "right" people (be that at the management level or from within the ranks) has proven invaluable in facilitating a greater flow of information in and around the industry.

An important part of the initial building process involved the development of two administrative information tools: client files and the network list.

3.1 Client Files

The client files contain general brochures, annual reports, staff resumes and notes regarding equipment, facilities, long-range plans etc. These files represent a significant collection of data about frontier-related industries and research performers.

3.2 Network List

The network list is a "people directory" comprised of three main categories: 1) network contacts, individuals with a direct technical interest in C-FER's research mandate; 2) friends of C-FER, individuals who have general interest or who hold management rather than technical positions; and 3) media contacts. The list is keyworded in several basic areas of interest: activity type (designer, researcher, fabricator etc); project type (offshore structure, pipeline etc); material type (steel or concrete); and project location (Arctic, Grand Banks, Scotian Shelf,etc). (A sample of the list may be found in Appendix B.)

The network list grew rapidly during C-FER's first year, reaching more than 500 in the first phase of the networking operation. It currently includes nearly 1,000. While the

majority of those on the list are contacts from the various industry segments involved in Arctic and offshore energy development, a recent shift in the make-up of the list reflects C-FER's growing involvement in downhole tubulars research. It is the intent of the networking team to continue this increased representation in the area of downhole tubulars to better reflect the additional attention now being paid to this area through C-FER's research program.

Tremendous time and effort were devoted to contact-specific activities during the first phase of the C-FER network, the primary responsibility for this lying with the Networking Officer. This intense level of activity dropped moderately during the second phase, with the networking team spending more time onn other aspects of networking and with an increasing number of person-to-person contacts coming via C-FER's research engineers. This shift from network-specific contacts to research-oriented ones exemplifies the intentional integration of the network and research aspects of C-FER's mandate. In addition, there is now something of a "ripple effect", with those in the network themselves suggesting additional people to be included in the network.

4.0 Workshops and Seminars

While one-to-one contacts are the framework for the C-FER network, the opportunity for information exchange provided by workshops and seminars has added an important dimension to the networking initiative. From the outset, such undertakings have been recognized as an important mechanism for facilitating interaction among various network contacts.

4.1 Participant-Led Workshops

Many of the workshops run by the C-FER network have been small, highly specialized sessions focussed on particular problems facing industry. Offered at little or no cost to delegates, they reflect C-FER's philosophy that the network is a service-oriented initiative. These small, "participant-led" technical sessions have proved to be a valuable method of information exchange and will continue as demand dictates. (A complete list of C-FER workshops and seminars is found in Appendix C.)

4.2 NOIR

A second type of workshop initiative is the series on Northern and Offshore Information Resources, sponsored jointly by C-FER and the Arctic Institute of North America (AINA). Originally conceived as a one-time effort, it became apparent during the first seminar that the initiative could well fill a need at various locations across Canada. As a result, "NOIR" evolved into a series which has, to date, been held at five locations across Canada. The sixth will take place in Toronto in April and consideration is being given to holding a seventh in the United States.

Although the first NOIR seminar was offered at no cost, a partial cost-recovery approach was adopted for each successive seminar. Both the technical audit and the more recent internal review indicated that there was ample justification to test the value of the series by charging a modest registration fee in order to cover hard-dollar costs of the seminars. A registration fee of $35 was levied at the second session, $45 at the third and fourth seminars, and $90 at the fifth. There has been no noticeable drop in attendance as a result of the registration fee.

A more detailed examination of the NOIR experience was the subject of a paper jointly authored by C-FER and AINA for presentation at an international conference held in Sweden in June 1986. A copy of that paper is included in Appendix C, as is a copy of the brief summary of proceedings of the first NOIR seminar (published as an insert in *Frontiers,* October 1985).

4.3 Offshore Structural Engineering

Another initiative which exemplifies C-FER's commitment to collaboration between industry and universities was a joint effort with the University of Alberta's Department of Civil Engineering. The twelve-week, graduate-level seminar "Offshore Structural Engineering" drew more than 40 registrants from both university and industry to hear some of Canada's leading experts in offshore structures. A full set of notes was prepared by a civil engineering graduate student and distributed to participants. (A list of speakers is included in Appendix C.) .

4.4 C-FER Fellow Special Symposia

While the original intent of the C-FER network was to concentrate on small, specialized workshops, reviewers at the technical audit suggested that there was also a place in the networking portfolio for larger sessions of a more international flavour. Responding to this, the network is currently in the process of planning two special symposia, built around the expertise of C-FER Fellows Alan Davenport and Ben Gerwick.

The C-FER Special Symposium on Steel-Concrete Composite Structural Systems is being planned as a part of POAC '87, the 9th international conference on Port and Ocean

engineering under Arctic Conditions, being held at the University of Alaska, Fairbanks from 17 to 21 August 1987. The one-day session will feature Ben Gerwick, internationally known consulting construction engineer from San Francisco, California. Experts from Canada, the United States, Great Britain and Japan will join with Mr. Gerwick for an intense examination of the design and behaviour of composite structures. It is anticipated that one outcome of the symposium will be a series of recommendations for consideration in the development of standards.

The second C-FER Special Symposium will take place on the 3rd and 4th of November 1987 in London, Ontario. Featuring Alan Davenport, Director of the Boundary Layer Wind Tunnel Laboratory at the University of Western Ontario, the session will focus on Environment, Design Criteria and Loads, with particular application to the proposed Canadian Standards Association Standard S471. Three separate but related half-day sessions will examine the key aspects of the preliminary standard. In each case, a panel of international experts will critique the session and lead in the development of recommendations for the consideration of the standards committee.

While workshops and seminars organized by the C-FER network are designed to facilitate the exchange of current information among all those in Canada's energy-related industries, special attention is given to representatives of C-FER Member organizations. For example, at such times as there is a registration fee for a workshop or seminar, a special reduced fee is levied to C-FER Members. In one instance, a "Members Only" breakfast was held prior to the workshop, enabling Members to meet with the key-note speaker for a level of dialogue not possible during the seminar itself. These "perks" for Member representatives will be integrated into future workshop planning as appropriate.

5.0 Publications and Public Relations

5.1 Newsletters

One of C-FER's major vehicles for information sharing is its suite of newsletters, *Frontiers* and *Networker*. Distributed to all those on the network list, the publications have a two-fold purpose: 1) to tell the C-FER story ; and 2) to assist in the dissemination of news of general interest to various frontier-related industries. This mix of in-house and external information has been acknowledged as important from the earliest stages of development.

Of the two publications, *Frontiers* demands the majority of time, effort and expense. A printed, two-colour publication prepared on a quarterly basis, it runs eight or twelve pages and includes an equal measure of C-FER-specific material and that of an external nature. Suggestions made at the time of the network audit regarding content and format have been implemented, as appropriate. In particular, recent issues have included Member Profiles (a successful mechanism for enhancing recognition of Canadian expertise) as well as more technical articles related to specific research underway at C-FER. As a rule, 1,250 of *Frontiers* are printed, 1,000 for immediate distribution and the rest for a variety of uses.

A major change in the publication process of *Frontiers* took place this winter, with the most recent issue of the newsletter being taken to the camera-ready stage using the Macintosh desktop publishing software package PageMaker. The savings in time and money has proved to be substantial. (The sample copy of *Frontiers* included in Appendix D was prepared using PageMaker.)

Networker is a more modest undertaking, a monthly newsletter duplicated on specially-designed letterhead (see sample, Appendix D). Of the two publications, *Networker* contains a far higher percentage of industry-specific information than does *Frontiers*. Designed more as a "throw-away", the run of *Networker* is not as great as that for *Frontiers*, with only 1,050 copies duplicated each month.

While the value of the publications is difficult to measure, increasing numbers of network contacts have approached C-FER with requests for inclusion of information in both *Frontiers* and *Networker*. Reports have come to C-FER indicating that, as a result of material published in the two newsletters, network contacts have, in turn, been contacted by others in industry with suggestions of assistance, requests for information etc.

5.2 Annual Report

C-FER's other major publishing effort continues to be the its Annual Report (see sample, Appendix D). A key public relations tool, the report has evolved into far more than just a bare bones document serving only to satisfy legislative requirements. Rather, the report focusses in some detail on the philosophy and direction of the Centre, its current research activities and its membership and networking initiatives. The 1986-87 Annual Report will be prepared using the Macintosh PageMaker software.

5.3 Downhole Tubulars Journal

A proposal is currently being prepared that would see C-FER establish an international, refereed journal focussed exclusively on research related to downhole tubulars. Considerable leg-work done last year indicates that there may be a knowledge gap in this

field. Interest from industry toward such a proposal is cautiously optimistic. Discussions with others involved in similar endeavours indicate that such a publication would be an undertaking of some considerable proportion, both financially and time-wise.

5.4 Public Relations

Promotion is important to the success of any viable organization and responsibility for this aspect of the C-FER operation falls within the networking portfolio.

5.4.1 Display

A free-standing, self-contained display was developed in the first few months and has been used extensively at a wide range of conferences and industry-related exhibitions. The original display panels have recently been updated to better reflect the duality of C-FER's current research in both offshore structures and downhole tubular systems. The display was designed in such a way as to be a joint effort with C-CORE, or as an individual effort.

5.4.2 Slides

The slide presentation developed in the early stages of C-FER's operation has expanded and evolved considerably. The slides, originally produced for C-FER by a local graphic designer, are now produced in-house, via the Macintosh PageMaker software package. Significant savings in time, money and flexibility have resulted. There are now several versions of the slide presentation available for use, ranging from a general talk to various research-specific technical presentations. While the slide presentation was first used

primarily by senior management, many research engineers now take the package on their travels, using it to give a general overview of C-FER's aims and objectives before moving into the specifics of their own areas of expertise.

5.4.3 Video Tape Presentation

A recent addition to the audio visual techniques used to raise C-FER's profile is a video presentation produced for C-FER by the University's Department of Radio and Television. The nine minute tape focusses on C-FER's Sucker Rod/Tubing Wear Testing Machine. It has proved to be a valuable information tool. Other such videos will be prepared as time and funding permit.

5.4.4 Periodical Articles

During the first phase of networking activities, considerable time was devoted to preparing general and technical articles for inclusion in a variety of industry periodicals. (A dozen or more such articles appeared during the first year alone.) Although the number of articles prepared in-house specifically for external publication has diminished, the number of stories picked up independently from *Frontiers*, *Networker* and even the Annual Report has increased. This would appear to indicate that C-FER's publications are being read and that they contain material that is of interest to a broad range of readers within industry.

The display, slides, video and various magazine articles are critical to C-FER's public relations effort. There are, however, many other miscellaneous tasks which fall under the P.R. umbrella including the preparation of a poster display for a C-FER co-op engineering student who attended a major national conference; the design and preparation of a

standardized series of C-FER report covers; and response to a wide range of requests for information about C-FER. All such initiatives are carried out to supplement the person-to-person contact which remains the foundation on which the C-FER network was developed.

6.0 Information Services

6.1 Information Centre

In the planning stages of the networking program, another tool intended to facilitate the flow of technology was an information centre which would act as the focal point for queries and data within C-FER's particular areas of technical interest. The objective was to have a visible, accessible centre which was clearly perceived by industry as "the" place to obtain information. Role models included such proven resources as the Ocean Engineering Information Centre (OEIC) at C-CORE and the Canadian Institute of Steel Construction.

However, it was decided early on that C-FER would not develop a bibliographic database focussed on frontier engineering since some 660 databases are currently available. While only a handful of these relate to C-FER's mandate, and none focusses exclusively on the mandate, it was apparent that this field was well serviced. A more specialized strategy was then developed, that being to identify the databases most relevant to the needs of C-FER and its Member companies and become expert in using them. However, a critical examination of time and resources available to the network resulted in the decision to postpone indefinitely the hiring of an information specialist to carry out this task. Instead,

the relationships that have developed with librarians and information specialists from various existing information sources (particularly the Alberta Research Council, the University of Alberta, the Arctic Science and Technology Information System [ASTIS] and OEIC) enable C-FER to channel requests directed to it to the appropriate information source.

6.2 C-FER Library

A separate question is that of C-FER's own library collection. While it was decided early on not to embark on a journey of bibliographic database development, nonetheless, there will always exist within C-FER the need to maintain a small, specialized in-house library containing select periodicals, various technical monographs, conference proceedings and reference material. As a result, an information specialist was hired on a free-lance basis to set in place a computerized mechanism for indexing and abstracting materials to be kept in this collection. Cataloguing of the holdings is done using a simple format which includes only the title; author; source and date published; location code (for shelving purposes); subject keywords; and abstract. (A sample listing may be found in Appendix E.)

The system was designed to be compatable with that of ASTIS, although on a much simpler scale. Discussions continue at this time with the Arctic Institute of North America regarding the possibility of mounting C-FER's library collection on the ASTIS on-line system. Such collaboration (although initially costly and time-consuming) could well benefit both C-FER and AINA.

One noteworthy contribution that C-FER has made in the field of information services has been its development of the seminar series on Northern and Offshore Information

Resources. Through this series, person-to-person contact has been made with specialists from virtually all the relevant information sources in both Canada and the United States. This has been a most valuable aid in replying to requests for assistance that come from C-FER Member companies and network contacts.

6.3 Offshore Structures Database

An activity which proceeded slowly during the first phase of networking activities (though not by intent) was the development of a database of information on structures and icebreakers operating in the Arctic. This was intended as a small start on describing actual and proposed structures for all of Canada's offshore frontiers. All publicly-available information was gathered from papers, brochures and articles. A precise engineering description of each structure was then requested from the respective owners: structural drawings, fabrication specifications; grades, tonnage and locations of steels used. At this point, progress slowed, with owners reluctant to release data in spite of assurances of confidentiality from C-FER. C-FER has since decided to continue to gather information as it becomes available, without proactively seeking out proprietary data.

6.4 Research Inventory

Another initiative to develop more slowly than anticipated has been the establishment of an expert source list or research inventory, initially focussed on specialists in various fields related to materials, design and construction of offshore structures but with a format that could be expanded to include those specializing in downhole tubular systems. Discussions with network contacts across Canada have indicated that this would be a valuable information tool. A proposal for such an inventory is progressing slowly.

7.0 Other Activities

7.1 Research Reporting

One specific application of the network is the gathering of research needs and the dissemination of results. Specifically, the C-FER network has recently taken on responsibility for ensuring that monthly progress reports are sent regularly to appropriate Member representatives.

For each project which is sufficiently active to have a Project Committee, the C-FER Project Officer prepares a brief Monthly Report summarizing current activities. Members of the Project Committee receive this report and are encouraged to call the Project Officer with questions or suggestions. For contract research, only the Client representative receives the Monthly Report. General overviews of research in progress are provided to all network contacts from time to time through articles in *Frontiers*.

In addition to providing a major mechanism of accountability to the end users of C-FER research, the reporting system is also designed to stimulate on-going dialogue between researcher and user. (A sample of a typical Monthly Report may be found in Appendix F.)

7.2 C-FER Atlantic

C-FER's commitment to collaboration is exemplified by the establishment on the campus of the Technical University of Nova Scotia (TUNS) of a collaborative research operation known as C-FER Atlantic. The mandate of the organization is two-fold: 1) to secure research projects in the areas of structural, metallurgical and welding engineering as they

relate to the construction and use of structures in Canada's offshore regions; and 2) to provide technical expertise not only to local C-FER Members but to others in industry as well.

While incubation of the satellite office was considered to be an important networking activity, progress in defining a unique and valuable niche was initially quite slow. With the involvement this past year of an experienced metallurgical and welding engineer, the prospects for appropriate research projects have increased. Interest in collaboration is currently being expressed by several manufacturers as well as by the shipbuilding industry. A number of proposals have been prepared for consideration by industry and by government. Specifically, discussions are underway with the Natural Sciences and Engineering Research Council, Mobil Oil, Hanson Materials Engineering, Bow Valley Offshore Drilling, Eastern Carbide Tools, Saint John Shipbuilding and MacLaren Plansearch.

In addition to undertaking research, C-FER Atlantic has the same commitment to networking as does C-FER. This commitment is reflected in the successful workshop co-sponsored by the east coast operation in September 1986 (see Appendix C).

As the research effort at C-FER Atlantic has moved into high gear, responsibility for the operation has shifted from C-FER's network into its research portfolio. The C-FER Atlantic Business Plan for the period October 1986 to March 1987 (see Appendix G) sets out in greater detail the goals and objectives of the centre.

7.3 University/Industry Research Centres

In May 1986, the Science Council of Canada sponsored a conference focussed on University/Industry Research Centres (UIRC) to which C-FER was invited. The Networking Officer and a member of the Board of Directors made a joint presentation on those factors influencing the success of a UIRC. C-FER was recognized as a successful organization and the network was acknowledged as an important ingredient in its success.

7.4 Network Consulting

A number of organizations have approached the C-FER network requesting assistance in the planning of like operations. Several are worth particular mention.

7.4.1 Technology, Research and Telecommunications

The recently formed Alberta Ministry of Technology, Research and Telecommunications (TRT) invited the C-FER network team to make a presentation related to the Centre's networking program, its history, development, success and future directions. The Networking Officer and Vice-President, Research were joined by the C-FER Director who took part in the Science Council's UIRC Conference. The session provided a productive information exchange, and has resulted in better communication links with TRT. The fact that a new department within the provincial government turned early on to C-FER for assistance in setting up its network is another example of recognition of the valuable and, apparently, unique role played by the C-FER network.

7.4.2 Science Institute of the Northwest Territories

The Science Institute of the Northwest Territories (SINT) was established last year in Yellowknife, NWT to foster increased research in the north and to develop an increased awareness of northern needs. Recognizing that a major part of its mandate will ultimately be in the area of networking, SINT asked that the C-FER Networking Officer spend some time in Yellowknife acting as a consultant to SINT as it developed a set of goals and objectives for its networking initiative. In addition, the Executive Director of SINT visited C-FER for follow-up meetings.

7.4.3 Arctic Institute of North America

The Arctic Institute of North America at the University of Calgary has embarked on a path of revitalization and reorganization. The new Executive Director of AINA approached C-FER with a request similar to that of SINT; that is, that the Networking Officer spend some time advising AINA on goals, objectives and *modus operandi* for a new position at the Institute focussed specifically on networking.

8.0 Conclusion

The development of an effective network has been a unique and challenging experience. Few readily applicable precedents exist. Nonetheless, progress during the past three years has been steady and substantial. The network has grown to nearly 1000, with client contacts from a wide range of frontier-related industries now linked together; the newsletters are in increasing demand; workshops, both series and single efforts, have

drawn well and have been recognized as both timely and constructive. C-FER's role as a facilitator in the exchange of technical information seems well established.

In addition, new initiatives being added to the roster will move the network program further along the path to success. Increased efforts to bring the downhole tubulars industry into the network will provide additional expertise and benefits; the proposed downhole tubulars journal could well provide a much needed source of information on state-of-the-art research in this field; and the combination of participant and expert-led workshops will cement C-FER's role as a conduit for the transfer of information.

Recent changes in the internal operations of the network are also expected to strengthen its effectiveness. As mentioned earlier, at the 8th meeting of the Board of Directors, a motion was unanimously approved that the Board Membership Committee be expanded to take on additional responsibility for the activities of the networking program. This move by the Board reflects its commitment to the network and provides a mechanism for its on-going accountability. It also reinforces the synergistic relationship of the Centre's networking and membership activities.

A strengthening of ties between C-FER's research and networking programs is reflected in the appointment last year of C-FER's original Networking Officer (L.B. Staples) to the new position of Vice-President, Research. This move has proved to be an effective way of increasing the integration of the Centre's two-fold mandate.

Above all, the network's continuing success is contingent upon two things: first, the ability to be both proactive and reactive, to blend innovation and collaboration in meeting the changing needs of C-FER's constituent groups; and secondly, the commitment of

Member companies, the clear recognition of and support for the view that the network is an integral part of C-FER's mandate.

Audit Review Team

Keith Glegg
Vice-President, Technology Transfer
National Research Council of Canada

Alex Hemstock
Past President
Canadian Council of Professional Engineers

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CANMET

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Stelco Inc.

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Group Sales Manager, Fabrication and Heavy Manufacturing
The Algoma Steel Corporation Limited

Board Membership and Networking Committee

Bill Grundy (Chairman)
Consultant

Ed Czaja
Executive Vice President
Shell Canada Limited

Ray Jonasson
Consultant

C-FER NETWORKING LIST
KEYWORD INDEX

ACTIVITY TYPE

FABR	Fabricator
GREG	Government/Regulatory
MATS	Material Supplier
ODES	Designer - Other
OWOP	Owner/Operator
RCHR	Researcher
SDES	Designer - Structural
LIBR	Librarian
PUBL	Publication
TDES	Designer - Tubulars & Drilling

PROJECT TYPE

ANST	Ancillary Structures
PIPE	Pipelines
SHIP	Ships/Barges
STRC	Offshore Structure
TBLR	Downhole Tubular Systems
TOPS	Topside Components

MATERIAL TYPE

CONC	Concrete
STCN	Steel - Canadian
STFR	Steel - Foreign

PROJECT LOCATION

ARTC	Arctic Islands
BEAU	Beaufort Sea
GBKS	Grand Banks
LBDR	Offshore Labrador
SCSH	Scotian Shelf
WCST	West Coast

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LIST TYPE

FRND	Friends of C-FER
MDIA	Media Contacts
NETW	Network Contacts
MBOD	Member - Board of Directors
MMBR	Member - Membership Committee
MNOM	Member - Nominating Committee
MRPC	Member - Research Policy Committee
MTCL	Member - Technical Council
CFER	Official Contact Person - C-FER Member Companies
TITL	Identifies those contacts whose title or other special circumstances preclude automatic printing of a mailing label.
CONTACT DATE	Date of last contact by letter or visit (YY MM DD) (blank if no entry)

NOTE: Maximum of 5 Type codes per line.

Alberta Research Council
7th Floor, Terrace Plaza
4445 Calgary Trail South
Edmonton, Alberta
T6H 5R7

Dr. R.W. Stewart
President

Activity Type:
Project Type:
Material Type:
Location Type:
List Type: FRND
Contact Date:

Alberta Technology, Research
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Mr. K.H.G. Broadfoot
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Project Type:
Material Type:
Location Type:
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Albery Pullerits Dickson and
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Activity Type: SDES
Project Type: STRC, PIPE
Material Type: STCN, STFR, CONC
Location Type: SCSH, GBKS, ARTC, BEAU
List Type: NETW
Contact Date:

Network Workshops

Survivability, Limit States Design Concepts and Environmental Loads

January 1985
Vancouver, British Columbia

Discussions among a small group of structural specialists centred on damage to steel plate in ice-resisting walls, and an examination of deformations that actually impaired serviceability and functionality.

Steels Fabricated for Low Temperature Service
January 1985
Toronto, Ontario

Shipbuilders, steel makers and welding consumable suppliers gathered in Toronto for a one-day invitational workshop sponsored by C-FER and the Welding Institute of Canada (WIC). The purpose of the workshop was to assist Canadian industry in preparing to meet the unique challenges presented by the use of steel specially-formulated for low temperatures.

Requirements for C-FER Tubular Products Lab

April 1985
Calgary, Alberta

Senior drilling engineers were brought together to advise C—FER regarding normal and extreme service loads to which casing and drill pipe are subjected. Comments were also given on specific types of testing and research that would be most useful to the operating companies.

Northern and Offshore Information Resources

May 1985
Calgary, Alberta

October 1985
Ottawa, Ontario

January 1986
Halifax, Nova Scotia

April 1986
Yellowknife, Northwest Territories
(In conjunction with the Annual Meeting of the Association of Canadian Universities for Northern Studies)

November 1986
Edmonton, Alberta
(In conjunction with the 25th Anniversary Conference of the Boreal Institute for Northern Studies)

C-FER and the Arctic Institute of North America have co-sponsored this series of seminars which, to date, has brought together more than 300 information specialists and end users for a productive information exchange. Representatives of many of the major information centres in Canada and the United States discussed existing information systems, new trends in information retrieval and dissemination, and methods of effective co-operation.

Ice/Structure Interaction

May-June 1986
Calgary, Alberta

Under contract from Public Works Canada, C-FER organized and hosted two two-day sessions which brought together representatives from industry, governments and universities to assess the impact of past research and to plan research still required for the safe and economical design of offshore structures. Proceedings from the seminars were prepared by C-FER and are available from the Canada Oil and Gas Lands Administration.

Cathodic Protection: A + or - in Corrosion Fatigue

September 1986
Dartmouth, Nova Scotia

C-FER Atlantic and CANMET co-sponsored this workshop at which nearly 60 delegates from Canada, the United States, Great Britain and Japan gathered to discuss corrosion fatigue behaviour of steel welded joints in sea water with particular emphasis on the role of cathodic protection. In addition, C-FER sponsored a by-invitation-only session for those C-FER Members attending the workshop. The private breakfast meeting featured Frank Walker, co-chairman of the session and Manager of the Engineering Metallurgy/General Steel Products Group, British Steel Corporation. Proceedings from the workshop are currently being prepared by C-FER Atlantic.

Toughness Requirements for Steel in Offshore Structures

February 1987
Edmonton, Alberta

This seminar drew together industry, government and university representatives involved in the development of the CSA Standard S473, with a view to formulating toughness requirements for plate and weldments to be used in fixed offshore structures. Guest speaker at the session was Dr. Joseph Corrado of the David Taylor Naval Ship Research and Development Centre in Bethesda, Maryland.

Workshops and Seminars: Planning in Progess

Northern and Offshore Information Resources

30 April 1987
Toronto, Ontario
(In conjunction with the Annual Meeting of the Association of Canadian Universities for Northern Studies)

Wear in the Oil Industry

4 June 1987
Edmonton, Alberta
(In conjunction with INTER-CAN '87)

C-FER Special Symposium on Steel-Concrete Composite Strucutral Systems

20 August 1987
Fairbanks, Alaska
(In conjunction with POAC '87)

C-FER Special Symposium on Environment, Design Criteria and Loads

3/4 November 1987
London, Ontario

NOIR: An Approach to Co-operative Marketing

Elizabeth Clarke
Centre for Frontier Engineering Research
C-FER Building
The University of Alberta
Edmonton, Alberta, Canada
T6G 2E2

Ross Goodwin
Arctic Science and Technology Information System
The Arctic Institute of North America
The University of Calgary
Calgary, Alberta, Canada
T2N 1N4

Paper presented to the Association of Canadian Universities for Northern Studies Annual Meetings, Yellowknife, April 17-19, 1986.

An earlier version of this paper will appear in the proceedings of the Eleventh Northern Libraries Colloquy, Luleå, Sweden, June 9-12, 1986.

Abstract

This paper describes the Northern and Offshore Information Resources seminars, held in four Canadian cities during 1985 and early 1986. The purpose of the seminars was to bring together information professionals and end-users to learn about available resources and methods of retrieval of information on northern and offshore regions. By cooperatively organizing and presenting the seminars, information providers were able to meet with, and describe their services to, large numbers of users at relatively low cost.

1. INTRODUCTION

The Centre for Frontier Engineering Research was established in late 1983 with a major grant from the Devonian Group of Charitable Foundations (a Calgary-based philanthropic organization), additional funding from the Governments of Alberta and Canada and the private sector, and substantial in-kind support from the University of Alberta. C-FER was created in response to industry need. Its primary mandate is to carry out research related to materials, design and construction of facilities used in the development of Canada's frontier petroleum resources. A second important role for the Centre is that of technology transfer. The C-FER Network was designed to act as a facilitator in the dissemination of existing knowledge relating to specific aspects of frontier engineering.

Considerable time was spent during the early stages of C-FER's development exploring ways in which the Network could best contribute to information transfer. Some avenues were readily apparent: person-to-person contact; workshops and seminars; and newsletters were all seen to play a part in moving information through industry, governments and universities. A fourth initiative that received consideration was an information service not unlike that of C-CORE's Ocean Engineering Information Centre.

In the course of determining the particular niche that C-FER might fill in this field of information service, discussions were held with numerous related centres. The Arctic Institute of North America, the Boreal Institute for Northern Studies, C-CORE, the Welding Institute of Canada and the Canadian Institute of Steel Construction were among those to provide valuable input to C-FER during its deliberations. It became apparent that with a number of top quality databases already focused on various aspects of northern and offshore information, C-FER's niche would not be in creating yet another such database, but, rather, in finding ways of facilitating the exchange of already available information.

It was at this point that C-FER and the Arctic Institute of North America first discussed the possibility of a workshop on northern and offshore information resources. For C-FER, the co-operative marketing initiative fit well into its general networking mandate: workshops had already been earmarked as one way of disseminating information at a variety of levels. For the Arctic Institute, the joint initiative was a logical part of the marketing component of the ESRF/ASTIS project.

Under the ESRF/ASTIS project, funded by the industry/government Environmental Studies Revolving Funds (ESRF), the Institute's Arctic Science and Technology Information System (ASTIS) was enhancing its multi-disciplinary bibliographic database in the ESRF priority subjects. Some of the funding provided by ESRF was earmarked for marketing of ASTIS to ensure that this information was disseminated as widely as possible. A seminar held in collaboration with C-FER and other information providers would be a cost-effective way of communicating with a large group of users.

2. NOIR: AN EXPERIMENT IN COLLABORATION

The first NOIR seminar was held in Calgary, Alberta, on 2 May, 1985. It was designed to bring information professionals and end-users together to learn about available resources and methods of retrieval of information on northern and offshore regions. Participants at the seminar fell into one of three main groups: i) the speakers, information specialists working for northern information services; ii) information professionals working for industry, government agencies and universities who rely to a great extent on the information provided by northern information services; iii) end-users, research scientists, engineers, and managers who rely on either of the other groups for their information needs.

The seminar was divided into two parts: first, a half-day session geared specifically for the speakers, which provided an opportunity for discussion on the ways and means of increasing co-operative information sharing; and, secondly, the seminar itself, at which the speakers presented overviews of their particular databases or printed information sources and then took part in a user forum discussing with delegates a variety of related subjects.

The speakers' pre-session was an important component of the first seminar. Since many information providers were coming to Calgary to speak at the seminar it made sense to provide time for them to get together to discuss issues of mutual concern. Much of the discussion at the pre-session focussed on marketing, and specifically on the need for more cooperation in marketing. In

addition to re-affirming the usefulness of collaborative seminars such as NOIR, the group recommended that information providers exchange and jointly distribute promotional literature, that joint display materials be prepared, and that joint exhibits at conferences be undertaken.

All of these recommendations have since been implemented. For example, during 1985 ASTIS displayed brochures for several other information providers at its booths at InterCan '85 in Edmonton, the Special Libraries Association annual meeting in Winnipeg, and the Canadian Library Association annual meeting in Calgary. AEIDC prepared a joint display for a group of six university institutes, which has since been used at several conferences. The same group of six institutes shared the cost of a booth at the Arctic and Offshore Technology Conference (AOTC) in Anchorage. AOTC and AEIDC organized an information workshop following that conference. It seems that the time was ripe for cooperative marketing, and that the pre-session at the Calgary NOIR was all that was necessary to start things moving.

The seminar itself was subdivided into two main sections: the morning and early afternoon were devoted to a review by speakers of their particular information centres or databases; the late afternoon took the form of a user forum, a 2-hour session designed to stimulate dialogue among the various groups represented at the seminar. Keynote speaker at the Calgary seminar was A.E. Pallister, President of Pallister Resource Management Ltd. His address to the gathering, entitled "Needed: An International Arctic Information System", was an excellent starting point for the user forum.

The first seminar taught us several things. We realized, for example, that the seminar would have benefited greatly from the inclusion of online demonstrations. The "hands-on" approach would have added much to the session, and it was agreed to include demonstrations in any future seminars.

We learned also that there was a need for guides or "pathfinders" to the many resources on northern information, both online and printed material. As one step in this direction, a decision was made to publish a summary of proceedings of the Calgary NOIR for broad distribution. Since then, we have committed ourselves to the much greater effort of publishing a single summary of proceedings for all four seminars.

Perhaps most importantly, we learned from both the information specialists and the end-users that there is a very real need for the sort of information exchange provided by NOIR. On the one hand, the speakers were unanimous in their view that a continuing co-operative marketing initiative would increase the effectiveness of information services both individually and collectively. On the other hand, the librarians and the end users who registered for the session agreed that it had provided them with the rare opportunity for dialogue on a subject of mutual importance. A key point made in this regard was the recognition that, to be most effective, seminars and other marketing initiatives should be collaborative in nature.

3. THE EVOLUTION OF A SERIES

It was readily apparent to us that NOIR had struck a responsive chord. Fifty-seven people attended the first seminar, and before its conclusion

representatives of Indian and Northern Affairs Canada had volunteered to help organize a similar session in Ottawa. So it was, then, that NOIR moved from a single experiment to become a series, to be run at several locations across Canada during the following year.

The second NOIR seminar was held in Ottawa, 2 October, 1985. Subsequent sessions were in Halifax, 10 January, 1986; and Yellowknife, 16 April, 1986. (See Appendices A and B.) The general format of the NOIR seminar series has been similar to the first NOIR, with two notable exceptions. First, there has no longer been a half-day pre-session for speakers. We felt that the purpose of that session had been fulfilled in Calgary and that further discussions amongst the speakers would occur informally before, during and after the NOIR seminars themselves. The second departure from the NOIR format was the addition of online demonstrations during the afternoon session (see Appendix C). While this has made the morning agendas very full, it has been a valuable addition to the sessions, as noted above.

The forum at the end of each seminar has been maintained, in order to obtain user's comments about the seminar itself and about problems in accessing northern and offshore information. Displays of sample publications, brochures, etc. have become an important part of NOIR, particularly since they allow participation by information services that are unable to attend in person. The practise of having an entertaining and informative luncheon speaker has been continued.

The agenda has varied from location to location, although a "core" of organizations has been involved in most of the seminars (see Appendix D). This variation on the initial agenda has also been by design, with each seminar tailor-made to meet the needs of the particular area involved. Therefore, in Ottawa, for example, the focus was more toward government information sources, while in Halifax the thrust was the offshore, and in Yellowknife the focus was clearly northern.

The series has picked up momentum as it has continued. The response has been consistently high, with an increasing percentage of end-users at each seminar. It has been particularly gratifying to us to have received support for the seminars at many levels. While the first NOIR was strictly a C-FER/AINA initiative, each successive NOIR has had one or more co-operating sponsors, whose contributions were essential to the success of the seminar.

The Ottawa seminar was held in co-operation with Indian and Northern Affairs Canada. In Halifax, it was the Bedford Institute of Oceanography Library that co-sponsored the session. Finally, in Yellowknife three groups joined forces in support of the NOIR initiative: the Science Institute of the Northwest Territories; the Government of the Northwest Territories Library, and the Association of Canadian Universities for Northern Studies. This collaboration is a critical component of the series and will continue as the series does. Preliminary plans are now underway for an additional seminar in Edmonton, Alberta in September 1986, co-sponsored by the Boreal Institute for Northern Studies.

To acknowledge the support of those agencies who have assisted us is important. More important, however, is to recognize the particular individuals involved. In Calgary, Judith Carrie organized AINA's contribution to the

seminar; in Ottawa, it was Monica Morrison, Northern Regulatory Review, and Ramma Kamra, INAC Library, to whom we are indebted; in Halifax, BIO's head librarian Betty Sutherland was an invaluable support; and in Yellowknife, Cynthia Ryan, Librarian for the N.W.T. Government, Dan Billing and Bob Janes of SINT, and Peter Adams of ACUNS were of tremendous help. To those individuals and their staffs, we say thank you.

4. FINANCING CO-OPERATIVE MARKETING

The first NOIR seminar was, as has been noted, an experiment in co-operative marketing. One of the decisions relating to that experiment was that we not charge a fee for the session. Our feeling was that a critical part of the experiment was to find out if, in fact, our perception was valid; that there was a need for NOIR. To do this, we wanted to draw together as many information professionals and end-users as we could. Hence, the "freebie". Co-sponsorship worked well, with C-FER picking up the "hard dollar" costs and sharing the organization and manpower costs with AINA.

Although that financial mechanism worked well, once the decision was made to turn NOIR into a series we felt it more appropriate to charge a nominal amount for the session. Our reasoning was two-fold: first, from a purely practical point of view, it was felt that both C-FER and AINA should re-coup some of the very substantial costs involved in running the seminars; and, secondly, we discovered during the user forum that there is a point of view that says that if something is of value, it is worth paying for. And so, for practical and philosophical reasons, we have initiated a small fee for the seminars ($35 each for Ottawa and Halifax; $45 for Yellowknife). By and large, the proceeds of the seminars have been put towards the travel costs for C-FER and AINA. In almost every case, speakers have paid their own expenses, although a portion of the proceeds of the seminars has been allocated to assist with these expenses, as necessary.

5. FUTURE DIRECTIONS

NOIR began as an experiment in collaboration, with C-FER and AINA recognizing the importance of information sharing. The series has evolved and matured in response to the needs expressed by information professionals and end-users alike.

NOIR has clearly filled a need. What is yet to be determined is the future direction of the series. Should it continue as it is? If so, where and when? If not, what changes should there be, and why? Should C-FER and AINA continue as primary sponsors, or should we step aside and let others in the field bring a new approach to the series? Such are the questions that we are currently addressing.

Of one thing we are sure however; and that is the importance of continued co-operation in information marketing. If C-FER and AINA are to continue the NOIR series (or a variation on the NOIR theme), we will do so best with the kind of support we have had to date. If there are others who wish to pick up the marketing ball and run with, we would encourage you to do so - but to do so with the spirit of collaboration that has worked so well for NOIR.

Appendix A

NOIR Statistics

	Calgary May 2/85	Ottawa Oct. 2/85	Halifax Jan.10/86	Yellowknife Apr. 16/86
Total Attendance	57	74	53	66
Number of Speakers	11	21	15	20
Number of Presentations*	11	20	18	19
Attendance by Organization Type				
Industry	52%	3%	10%	2%
Consultants	15%	19%	23%	8%
Government	8%	61%	42%	61%
University	19%	11%	21%	17%
Others	6%	6%	4%	12%
Attendance by Background				
Information Professionals	61%	47%	49%	32%
End-Users**	39%	53%	51%	68%

* Sometimes two or three speakers shared a single presentation. On the other hand, speakers sometimes made a second presentation for someone who could not attend in person.

** Those whom we did not know to be information professionals were assumed to be end-users.

Appendix B

Speakers at One or More NOIR

Alice Abel	Dene Nation Library
Peter Adams	Association of Canadian Universities for Northern Studies
Don Albright	Indian and Northern Affairs Canada
Martha Andrews	Institute of Arctic and Alpine Research
Jamie Bastedo	Northern Land Use Planning Office
Russell Boals	HYDAT, Environment Canada
Ann Brennan	World Data Center A for Glaciology
Phillip Brown	QL Systems Ltd.
Bonnie Bullock	Canada Institute for Scientific and Technical Information
Heather Cameron	ASFIS, Fisheries and Oceans Canada
Serge Campion	Transport Canada
Judith Carrie	Arctic Institute of North America
Marc Charette	NAQUADAT, Environment Canada

Elizabeth Clarke	Centre for Frontier Engineering Research
Nita Cooke	Boreal Institute for Northern Studies
Deborah Diemand	Centre for Cold Ocean Resources Engineering
Mary Joan Dunn	National Library of Canada
Eileen Edmonds	Yukon Archives
George Ekins	Transportation Development Centre
Rosalie Fox	National Library of Canada
Ross Goodwin	Arctic Institute of North America
Steve Grant	Fisheries and Oceans Canada
Doug Gregory	Fisheries and Oceans Canada
Jacques Guerette	Canada Centre for Remote Sensing
Bob Janes	Science Institute of the Northwest Territories
Alfred Johnson	National Mineral Inventory; Energy, Mines and Res. Canada
Albert Joseph	Canada Institute for Scientific and Technical Information
Helen Joseph	Canada Oil and Gas Lands Administration
Ramma Kamra	Indian and Northern Affairs Canada
James Kanasy	CANMET; Energy, Mines and Resources Canada
Carolynn Kobelka	Prince of Wales Northern Heritage Centre
Claire Koven	Pallister Resource Management Ltd.
Alan Longhurst	Fisheries and Oceans Canada
Marty Lovelock	Canadian Transport Commission Library
Monica Morrison	Indian and Northern Affairs Canada
Gordon Nelson	Northern Studies Trust
Judith Nogrady	Transportation Development Centre
Laurie Nowakowski	N.W.T. Occupational Health and Safety Resource Centre
Anna Oxley	Atlantic Fisheries Service, Fisheries and Oceans Canada
Ernie Pallister	Pallister Resource Management Ltd.
Jeff Pallister	Ministry of State for Science and Technology
Leith Peterson	Dene-Metis Secretariat
Marion Pape	N.W.T. Public Library Services
Louise Power	WATDOC, Environment Canada
David Reade	GEOSCAN; Energy, Mines and Resources Canada
Ruth Rintoul	QL Systems Ltd.
Alan Ruffman	Geomarine Associates Ltd.
Cynthia Ryan	Government of the Northwest Territories Library
Jonathan Sears	Cambridge Scientific Abstracts
Andy Sherin	Atlantic Geoscience Centre, Fisheries and Oceans Canada
Michael Simmons	Tydac Technologies Ltd.
Barbara Sokolov	Arctic Environmental Information and Data Center
Betty Sutherland	Bedford Institute of Oceanography
Stephen Talko	Electronic Atlas; Energy, Mines and Resources Canada
Joy Tillotson	Institute for Marine Dynamics
Ross Wein	Fire Science Centre
Judith Whittick	Ocean Engineering Information Centre
Margo Young	University of Alberta Library

A total of 58 people have spoken at NOIR.

Appendix C

Systems Demonstrated at One or More NOIR

ASFA (CAN/OLE)	ASFIS, Fisheries and Oceans Canada
ASFA on CD ROM	Cambridge Scientific Abstracts
ASTIS (QL)	Arctic Institute of North America
AQUAREF (CAN/OLE)	WATDOC, Environment Canada
BNT (QL)	Boreal Institute for Northern Studies
BOREAL (CAN/OLE)	Boreal Institute for Northern Studies
CAN/OLE	Canada Inst. for Scientific and Technical Information
CANREG (CAN/OLE)	National Library of Canada
CENV (QL)	WATDOC, Environment Canada
COLD (ORBIT)	USACRREL/LCCRBP
DOBIS	National Library of Canada
GEOSCAN	Geological Survey of Canada
MNP(QL)	CANMET; Energy, Mines and Resources Canada
MNT(QL)	CANMET; Energy, Mines and Resources Canada
NAQUADAT	Environment Canada
OONL (CAN/OLE)	National Library of Canada
OOT (CAN/OLE)	Transport Canada
QL	QL Systems Ltd.
RESORS	Canada Centre for Remote Sensing
Spatial Analysis System	Tydac Technologies Ltd.
Wood Buffalo GIS	Fire Science Centre, University of New Brunswick

A total of 21 systems or databases have been demonstrated at NOIR. The online service on which a database was accessed is given in parentheses.

Appendix D

The Core NOIR Group

Level of Participation (see below)	Cal. ABC	Ott. ABC	Hal. ABC	Yel. ABC
Arctic Environmental Info. and Data Center	XX	XX	XX	X
Arctic Institute of North America	XX	XXX	XXX	XXX
ASFA (Fish. & Oceans Can./Cambridge Sci. Ab.)		X	XXX	XXX
Ass'n of Canadian Universities for North. Studies		X		XX
Boreal Institute for North Studies	XX	XXX	XXX	XXX
C-CORE/OEIC/CSIIS	XX	XX	XX	X
Canada Institute for Sci. and Tech. Info.		XXX	XXX	XXX
Centre for Frontier Engineering Research	XX	XX	XX	XX
Indian and Northern Affairs (Ott. Lib./Yel. Lib.)	X	XX		XX
Institute of Arctic and Alpine Research	XX		X	X
National Library of Canada		XXX		XXX
Pallister Resource Management Ltd.	XX	X	X	XX
QL Systems Ltd.		X X	XXX	XXX
Transport Canada Library/Transportation Dev. Centre	XX	XXX	XXX	X
USACRREL/LCCRBP	X	XXX	XX	X
WATDOC/NAQUADAT/HYDAT		XXX	XXX	X
World Data Center A for Glaciology	XX	X	X	X
Yukon Archives/Beaufort Sea Library	X			XX

Levels of Participation

A - system demonstrated
B - spoke, or had paper read
C - paper handed out or published in proceedings; and/or materials displayed

The core NOIR group is arbitrarily defined as those organizations that have participated in two or more NOIR. Membership in this group is therefore partly the result of selection by the organizers of each NOIR, and partly a function of organizations' interest and financial ability to attend. When defined in this way, and in several cases treating branches of the same organization as one, the core group consists of 18 organizations. Approximately 25 additional organizations have participated in a single NOIR, usually when held in their local area.

Northern and Offshore Information Resources
May 2, 1985

Sponsored by

Arctic Institute of North America
Centre for Frontier Engineering Research

Summary of Proceedings

A workshop on Northern and Offshore Information Resources was held in Calgary on Thursday, 2 May, 1985. Sponsored by the Arctic Institute of North America (AINA) and the Centre for Frontier Engineering Research (C-FER), the day-long session brought together information specialists, librarians and end-users for a discussion focussed on retrieval and dissemination of northern and offshore information.

The morning session took the form of a research inventory and featured a review of selected information systems currently available. The afternoon was designed as a user forum, with participants involved in a productive idea exchange. Keynote speaker at the workshop luncheon was A.E. (Ernie) Pallister, President of Pallister Resource Management Ltd., who spoke to the group regarding the need for an international Arctic information system.

The group was unanimous in its recognition of the need to co-ordinate communications efforts. The summary of proceedings presented here is one attempt at doing that. The material is in summary form only. More information on the specific sources reviewed may be obtained by contacting the individuals indicated.

Arctic Science and Technology Information System

The Arctic Science and Technology Information System (ASTIS) is a multi-disciplinary bibliographic database begun in 1978 by the Arctic Institute of North America. The majority of material in the ASTIS database (currently containing more than 16,000 citations) has been published since 1978; most entries have full abstracts and one or more location codes indicating libraries which hold the original document.

Until late 1984 the database focussed entirely on the Arctic, with emphasis on the Canadian Arctic and Arctic waters, with a minimal amount of material on Alaska, Greenland, Scandinavia and the Soviet Arctic.

The ESRF/ASTIS project, begun in late 1984, will considerably enhance the ASTIS database through the inclusion of priority subjects of the Environmental Studies Revolving Funds (ESRF). These subjects include ice scour; icebergs; oil spills; bottom sediment transport; waves; effects monitoring; northern terrestrial environmental impacts; and socio-economic issues. ASTIS will produce series of bibliographies on these subjects as the database is enhanced.

ASTIS has four main sources of information: 1) the Arctic Institute of North America Library; 2) the University of Calgary Library; 3) the Ocean Engineering Information Centre; and 4) the ESRF Program Study Committees.

Publications and services of ASTIS include the ASTIS on-line database, currently available through QL Systems Ltd.; the ASTIS Reference Service; two periodical publications, the bi-monthly *ASTIS Current Awareness Bulletin* and the annual microfiche *ASTIS Bibliography*; and the previously-mentioned series of ESRF bibliographies.

For more information, contact Ross Goodwin, Manager, ASTIS, telephone (403) 220-4036.

Ocean Engineering Information Centre

Included in the offshore information network in St. John's, Newfoundland, are a number of university, government and industry organizations.

University:
The Ocean Engineering Information Centre (OEIC) provides an information service and access to a specialized technical report collection. Included in the service are the publication of the *OEIC Information Bulletin*, which lists all recent documents received by OEIC; and the *OEIC KWOC Index on Microfiche*, an index listing all documents in the OEIC collection.

Bibliographic information on cold ocean engineering documents in the OEIC collection is transferred onto the ASTIS database, giving increased access to the availability of documents located at OEIC.

C-CORE, the Centre for Cold Ocean Resources Engineering, undertakes research in the cold oceans. It distributes *C-CORE News* (free of charge) and *C-CORE Publications* (on a cost-recovery basis).

C-CORE has also developed an on-line computer database, the

Canadian Sea Ice Information System (CSIIS), a database which has abstracted and compiled all marine ice data for Canadian waters. Ice data are presented as raw data which can be manipulated by means of a statistics package, as author-tabulated or as textural information.

Other university organizations involved in marine research are the Newfoundland Institute for Cold Ocean Science (NICOS); the Marine Sciences Research Lab (MRSL); and the Centre for Earth Resources Research (CERR).

Government:
Relevant government information resources include the Northwest Atlantic Fisheries Centre (Department of Fisheries and Oceans). The Centre has a very large collection of material indexed on the Fisheries and Oceans on-line database, WAVES; the Institute for Marine Dynamics (NRC), whose technical collection is indexed on DOBIS; and the Royal Commission on the Ocean Ranger Marine Disaster, whose technical collection is indexed on its on-line database, RANGER.

Industry:
There are in St. John's a number of offices for the petroleum industry (including Petro-Canada, Mobil Oil, Husky Oil, Esso Resources and BP Canada), as well as many consultants in ocean science and engineering.

Many of these, particularly the consultants, use the information resources provided by the university and government organizations outlined above.

For more information, contact Judith Whittick, Head, OEIC, telephone (707) 737-8351.

Boreal Institute for Northern Studies

The Boreal Institute for Northern Studies, a part of the University of Alberta, has as its major objective the acquisition and dissemination of knowledge on the north. Its primary region of interest includes northern Alberta, the Yukon and the Northwest Territories. Two methods of accessing northern information were outlined at the workshop.

Boreal Northern Titles, a monthly KWIC (keyword in context) Index, is compiled from headlines from native and northern newspapers and the first-named author and title from journals, government documents and other ephemera received by the Boreal Library. A good current awareness tool, *Boreal Northern Titles* may be purchased from the Boreal Library in hardcopy or accessed on-line through QL Systems Ltd.

BOREAL is the on-line catalogue of the Boreal Institute Library. It lists material acquired and catalogued by the Library since 1977. The database includes references not only to monographs, theses and microforms, but also to chapters in books, articles in periodicals, etc. All subject areas as they relate to the Arctic and cold regions are covered, with particular emphasis on northern Canada and Alaska. The database can be accessed either through SPIRES at the University of Alberta or through CAN/OLE.

For more information, contact G.A. (Nita) Cooke, Librarian, Boreal Institute, telephone (403) 432-4409.

Transportation Development Centre

The Transportation Development Centre (TDC) is the R&D arm of Transport Canada. It has a strong program on marine transportation technology of which Arctic operations are of prime interest.

The two most important projects of particular relevance to northern and offshore information specialists are: 1) *Ships Navigating In Ice, A Selected Bibliography v.2., 1980-1984;* and 2) a revised and expanded edition of the 1980 *Guide to Marine Transportation Information Sources in Canada.*

In addition, TDC's Marine Technology Transfer Strategy is designed to identify the needs of Canada's marine industry in order to foster relevant R&D.

For more information, contact Judith Nogrady, Head, Research Library, TDC, telephone (514) 283-4008.

Arctic Environmental Information Data Centre

The Arctic Environmental Information Data Centre (AEIDC) is a research institute of the University of Alaska-Fairbanks. Located in Anchorage, the Centre's mission is environmental information transfer and dissemination. AEIDC is a referral centre, not a repository. A major resource is the *Current*

Research Profile for Alaska, an annual directory of research activities which provides both a description of projects and the current addresses of researchers.

Some of AEIDC's technical publications include a *Sea Ice Atlas*, a *Climatic Atlas* and reports on superstructure ice and storm surges. Work is currently progressing on a coastal strategic resources atlas of the Beaufort, Chukchi and Bering Seas.

The University of Alaska's Rasmuson Library is implementing a university-wide circulation system called GNOSIS, a system which will automate a number of existing indexes of Alaska materials.

The State of Alaska has funded the loading of holdings of the major Alaska libraries onto the Washington Library Network (WLN). This bibliographic utility provides a giant card catalogue of the holdings of the member libraries; as such, it is an excellent resource for Arctic and Alaska materials.

On a national level, the Arctic Research Policy Act of 1984 (ARPA) requires a national Arctic research plan. All federal U.S. agencies will need to be in compliance with the plan in order to receive funding. AEIDC has been invited to submit a proposal to design a national Arctic information system for the 1987 plan. While this is a design for a U.S. network, it cannot ignore Canadian Arctic sources and Arctic information users. Any such design must therefore involve a study of what already exists and an in-depth analysis of user needs.

For more information, contact Barbara Sokolov, Supervisor, Information Services, AEIDC, telephone (907) 279-4523.

World Data Center A for Glaciology

The World Data Center (WDC)-A for Glaciology (Snow and Ice) in Boulder, Colorado, is one of three international data centres serving the discipline. The major purpose of these centres is to facilitate the international exchange of data on all forms of snow and ice. The topics included cover avalanche research; freshwater ice; glacier fluctuations; glacier mass balance; ground ice (permafrost); paleoglaciology; polar ice sheets; sea ice; and seasonal snow cover.

Co-located with the WDC-A is the National Snow and Ice Data Center (NSIDC), a national information and referral centre for the snow and ice community.

WDC/NSIDC archives digital data on numerous areas of snow and ice research. The majority of data sets relate to snow cover and sea ice but there are also other data archived in the areas of glacial geophysics, Great Lakes ice-related environmental studies, and satellite microwave research.

WDC/NSIDC serves as an archive for published material on snow and ice. It has an automated system for the storage and retrieval of bibliographic data and can provide copies of research papers and data on request.

A quarterly *New Accessions List* offers subject access to new material. In addition, WDC publishes *Glaciological Data* twice a year.

WDC/NSIDC maintains a representative library collection of reprints, technical reports, monographs and conference proceedings in the field. Snow cover and sea ice data sets are the primary focus of the digital archives. In addition, the Centre has charts of snow and ice limits for most areas of the Northern Hemisphere. It also archives selected data relevant to climatological as well as glaciological research.

For more information, contact Ann Brennan, Information Specialist, WDC-A, telephone (303) 492-5171.

Other Major Resources

The final presentation of the morning session was an overview of several other major northern and offshore resources given by Martha Andrews, Institute of Arctic and Alpine Research (INSTAAR), University of Colorado.

She began with a review of some of the major databases available through DIALOG. Those highlighted include AQUALINE, access to information on every aspect of water, water waste and the aquatic environment; BIOSIS PREVIEWS, a comprehensive worldwide coverage of research in the life sciences; COMPENDEX, the machine-readable version of Engineering Index; GEOARCHIVE, a comprehensive geoscience database; NTIS, consisting of (U.S.) government-sponsored research, development and engineering plan analyses prepared by federal agencies, their contractors or grantees; OCEANIC ABSTRACTS, technical literature on marine-related subjects; and WATER RESOURCES ABSTRACTS, prepared from materials collected by more than

50 water research centres and institutes in the United States.

For more information on DIALOG, contact (in Canada) Micromedia, telephone (416) 593-5211.

She then reviewed two of the major database services currently available on-line through SDC. COLD is an automated, machine-readable database sponsored by and prepared for the Cold Regions Research and Engineering Laboratory (CRREL), Hanover. COLD includes government reports, journal articles, conference proceedings, monographs, CRREL reports, patents, dissertations and specialized research reports focussed on hydrology, meteorology, climatology, engineering geology and geophysics.

TULSA is an on-line database produced by the University of Tulsa Information Services Department. It provides worldwide coverage of literature and patents related to the exploration, development and production of oil and natural gas, including the fields of geology, geophysics and geochemistry; drilling, well logging, well completion and services; oil and gas production; reservoir studies and recovery methods; petroleum and transportation and storage; ecology and pollution; and alternative fuels and energy sources.

For more information on SDC and its available on-line databases, contact (in Canada) Infomart, telephone (416) 238-4588.

Finally she reviewed a wide range of currently available printed bibliographies which she felt were useful sources of information.

A copy of the annoted list of such bibliographies may be obtained by writing to the editor of *Frontiers*.

User Forum

An important part of Northern and Offshore Information Resources was the afternoon session, a user forum intended to stimulate dialogue. A resumé of that idea exchange was prepared for inclusion here by Judy Carrie, then Information Specialist with the ASTIS/ESRF project.

Needs

The specific needs identified were varied. They ranged from on-demand specialized source bibliographies to immediate on-line access to databases. Many groups mentioned the need to standardize or, at least, coordinate activities to provide less confusion to the user. Some suggested an interface to provide access to many databases, acknowledging the fact that one large database was not a practical solution.

Databases of ongoing research and more databases combining bibliographic data with primary source material were recommended.

Marketing

This was seen as a universal problem and likened to that of marketing library services within an organization. (It was previously thought that information is powerful and inately good; therefore, everyone knows what the library does and there was no need to market.)

Suggestions for effective marketing to target specific user groups included:

- Participation in professional conferences (joint av presentations, brochures, joint booths, another workshop);
- Joint brochure(s) produced to combine services of all relevant organizations targeting a specific profession or industry;
- Advertise in professional journals;
- Summary of the workshop to interested groups;
- Central information number to direct queries to relevant service(s);
- Electronic bulletin boards.

Directories and Information Guides

Directories listing information suppliers and on-line databases as well as libraries are needed. On-line updating and access was suggested to ensure that information is current.

Guides or "pathfinders" to all resources of northern information would be helpful as long as they are geared to specific groups and marketed well.

Participants agreed that an important question was that of funding, with the group unanimous that every effort should be made to "tap" all available sources for additional moneys.

This summary of proceedings of Northern and Offshore Information Resources was first published as an insert in the October 1985 issue of Frontiers. *Additional copies of the insert may be obtained by contacting The Editor,* Frontiers, *C-FER Building, University of Alberta Campus, Edmonton, Alberta T6G 2E2, telephone (403) 432 5108.*

A similar workshop, also sponsored jointly by AINA and C-FER, was held in Ottawa on 2 October. A third is planned for the east coast early in 1986.

C-FER - UNIVERSITY OF ALBERTA

OFFSHORE STRUCTURAL ENGINEERING

JANUARY 15	"ARCTIC AND OFFSHORE PRODUCTION STRUCTURES" Mr. R. Pan Senior Advisor Frontier Development Gulf Canada Resources
JANUARY 22	"DESIGN OF DOME'S ARCTIC OFFSHORE STRUCTURES" Mr. J. Fitzpatrick Staff Engineer - Structural Engineering & Production Dept. Dome Petroleum Limited
JANUARY 29	"WELDING, METALLURGICAL AND CORROSION CONSIDERATIONS FOR OFFSHORE STRUCTURES" Mr. P. Blakesley Metallurgical Coordinator C-FER
FEBRUARY 5	"ICE LOADING ON OFFSHORE STRUCTURES" Mr. K. Croasdale President K. Croasdale & Associates
FEBRUARY 12	"WIND AND WAVE CLIMATES FOR OFFSHORE STRUCTURES" Dr. A. Davenport Director, Boundary Layer Wind Tunnel Laboratory Faculty of Engineering Science University of Western Ontario
FEBRUARY 19	READING WEEK
FEBRUARY 26	"FOUNDATION CONSIDERATIONS FOR OFFSHORE STRUCTURES" Mr. D. Haley Vice President EBA Engineering Consultants Ltd.

MARCH 5 — **"ESSO'S CAISSON RETAINED ISLAND"**
Mr. M. Comyn
Naval Architect
Drilling Operations
Esso Resources Canada Limited

MARCH 12 — **"RESEARCH TO SUPPORT OFFSHORE STRUCTURE DESIGN"**
Mr. T. Marion
Section Head
Materials Technology
Esso Resources Canada Limited
Research Department

MARCH 19 — **"DESIGN PROCEDURES FOR OFFSHORE STRUCTURES"**
Mr. D. Andrews
Vice President
Tri-Ocean Engineering Ltd.

MARCH 26 — **"CONSTRUCTION PROCEDURES FOR THE ARCTIC"**
Mr. D. Stenning
President
Arctic Offshore Engineering Ltd.

APRIL 2 — **"DESIGN OF BOW VALLEY'S MAI"**
Mr. K. Pullerits
Partner
Albery, Pullerits, Dickson and Associates

APRIL 9 — **"PROSPECTS FOR ARCTIC DEVELOPMENT"**
Dr. A.E. Pallister
President
Pallister Resource Management Ltd.

Centre for Frontier Engineering Research

Frontiers

A quarterly forum *Volume 3, Number 2, January 1987*

Maurice Slack takes a seal quality measurement from a tubing connection

CFER

Member Profile: Stelco R&D Department

Support for C-FER comes from its Member companies representing industry, governments and universities in Canada. The following is the third in a series of Member Profiles. Stelco Inc. was one of the first companies to provide financial backing for C–FER.

It is twenty-five years since Stelco's Research and Development (R&D) Department was officially established. Its mandate? To conduct and coordinate corporate-wide applied research and development activities in both products and processes. Five years after the R&D Department gained its own separate status, it also gained its own facility, the Stelco Research Centre, a 62,000 square foot centre in Burlington, Ontario. According to J.C. (Jock) McKay, Director of Research and Development, the centre was the first of its kind created in Canada for the principal purpose of applied research in iron and steel manufacturing and product technology.

The general functions of the R&D Department fall into four main areas: (1) *protective research* (46% of projects), the improvement of Stelco products and processes to keep them at the desired competitive level; (2) *aggressive research* (30%), the seeking out, assessment and promotion of state-of-the-art technology for early adoption by Stelco; (3) *troubleshooting* (17%), the solving of chronic or acute technical problems affecting probability; and (4) *future-assurance research* (7%), the creation of new products and processes to fulfill special company needs.

In the carrying out of these four main functions, the department is divided into three project sections: primary processes, manufacturing processes and product development. Each section is involved in advanced technical investigations of steel production, processing or products. In cooperation with other Stelco departments, they endeavour to introduce new or better technology in the mills and to identify novel procedures or products which may have future applicability.

According to Mr. McKay, Stelco researchers are increasingly focussing on process refinement, with its associated cost reductions and quality improvements. He adds, "With the new, market-driven orientation of Stelco, product development by our staff is not complete until the steel is successfully in use at customers' plants."

Current investigations in the primary processes section include coking cycle measurement and control; blast furnace burden distribution and energy consumption; BOF process control; and continuous slab casting.

Research in the manufacturing processes section includes projects in the primary rolling; hot strip and plate rolling; cold rolling and coating; rod and bar processing; and wire production. In particular, work is directed towards process development; production control systems; and yield improvement.

The product development section is currently focussed on research into improved automotive steels; galvanized strip quality improvement; high performance pre-painted steel strip; and high quality ERW tubing.

A key role of the support groups in the R&D Centre is in the area of technical information exchange, where specialists seek out and provide

C-FER Members

Consulting Companies
EBA Engineering
The Engineers Collaborative
GEOTECHnical resources
Hanson Materials Engineering
Kasten, Eadie Engineering
Reid Crowther
Stanley Associates Engineering
Sandwell Swan Wooster
Viatec Resource Systems

Energy Industry
Bow Valley Industries
Computalog Gearhart
Diversified Drilling Services
Dome Petroleum
Esso Resources Canada
Gulf Canada Corporation
NOVA, An Alberta Corporation
Petro-Canada Resources
Shell Canada
Syncrude

Steel Industry
Algoma Steel
AMCA International
IPSCO
Stelco

Foundations
Devonian Group of Charitable Foundations

Government
Alberta Oil Sands Technology and Research Authority
Government of Alberta
Government of Canada
Energy, Mines and Resources
Regional Industrial Expansion
National Research Council

Universities
Technical University of Nova Scotia
University of Alberta

information needed to help solve Stelco's technical problems. In addition, they direct the collection of information on technologies new to Stelco and assess their potential significance to the company. A sophisticated current awareness initiative keeps Stelco researchers and other key company personnel up-to-date on the latest published literature; considerable effort goes toward communication and co-operation with experts from the steel industry and other sources throughout the world.

From the outset, Stelco, through its R&D Department, has been committed to a program of support for post-secondary education. Chairs in Metallurgy at McMaster University and the University of British Columbia support university activities of the highest standard in the field of ferrous metallurgy. Work at McMaster focusses primarily on iron and steelmaking research; that at UBC is currently concentrated on steel processing research. In addition, Stelco provides three Graduate Research Fellowships each valued at $10,000 per year and 150 University or College Entrance Scholarships.

Stelco's R&D Department currently employs 100 people, 47 of whom are graduate scientists or engineers, and the remainder technologists and support staff. R&D expenditures in 1986 were approximately $10 million.

Stelco Inc. was established in 1910. Raw steel produced at two integrated plants (Hilton Works in Hamilton, Ontario and Lake Erie Works at Nanticoke, Ontario) and two mini-mill plants (Edmonton, Alberta and Contrecoeur, Quebec) is rolled into plate, sheet, bar and rod products. Three separate business units make and market Stelco's fastener and forging, wire and tubular products.

Weld Corrosion Study Underway

As the MV "Arctic" ploughs its way through ice-infested northern waters, engineers at C-FER are gaining valuable information for a research project on hull weld corrosion. Collaborating with AMCA International, Canarctic Shipping, CANMET and Port Weller Dry Docks, C-FER has undertaken a research initiative designed to observe and document in-service weld zone corrosion on the recently upgraded Class IV ice-rated cargo ship and research vessel.

The project is the first study of Canadian steels in arctic marine service in which weld corrosion is being rigourously documented and monitored *in situ* over a significant duration. The primary thrust of the project is to observe, measure and understand weldline corrosion in the new hull of the MV "Arctic" as it occurs under actual service conditions. These results are being correlated with various laboratory techniques to assess their predictive reliability. Confirmation of accurate lab tests should diminish the future necessity for extensive, time-consuming field trials of different combinations of plate, consumables and welding procedures.

Work on the project began last spring when the MV "Arctic" was in dry dock for a major upgrading. Eight individual weld lengths, integral with the port side hull plating, were attached for exposure to seawater corrosion and ice abrasion below the waterline of the vessel. Three of the six vertical weldlines were subdivided into three sections with each subsection weld-capped with a different experimental corrosion-resistant electrode. The remaining welds represent current fabrication practice incorporating both the shielded metal arc and submerged arc welding processes. Companion weld coupons were fabricated for laboratory testing.

The first inspection of the field welds took place last November when the MV "Arctic" was in Antwerp, Belgium delivering a cargo of zinc and lead ore from the Polaris mine on

Duane DeGeer takes a profile measurement of a weld replica obtained from the MV "Arctic."

Little Cornwallis Island. C-FER research engineers travelled overseas and, while the ship was in dry dock for repairs, examined and photographed the welds and took a series of polysulphide-based impressions for 3D replication of selected weld profiles.

Once back in Edmonton, the engineers undertook a thorough examination of the cast replicas, measuring carefully for weld metal and HAZ corrosion. Results from the first inspection were, as predicted, minimal. According to Duane DeGeer, one of the C–FER engineers involved in the project, quantitative weld metal loss and HAZ attack were almost non-measurable after only six months. As the project progresses, however, he and Bernie Luft, the project officer, expect to gain valuable information about the relative behaviour of the various weld metals and experimental electrodes.

Important to the research project are two series of parallel long-term laboratory corrosion tank studies, one being carried out at C-FER and the other at CANMET. Metallurgical assessment and corrosion tests are being performed and the data developed will be correlated with the observed, in-service corrosion.

Best
Wishes

for the
New Year
from C-FER

Centre for Frontier
Engineering Research

BLWT Encourages Industry Collaboration

In a move designed to ascertain Canadian industrial research needs and foster increased collaboration with industry, the Boundary Layer Wind Tunnel Laboratory (BLWTL) at the University of Western Ontario has begun a series of discussions with industry.

The Boundary Layer Wind Tunnel was built in 1965 to investigate certain classes of aerodynamic problems associated with the effects of natural wind in the boundary layer near the ground. Although it was built specifically with civil engineering wind loading problems in mind, other important problems such as air pollution and environmental winds have also been addressed.

Alan Davenport, one of C-FER's two Fellows, is the Director of the Boundary Layer Wind Tunnel. It is his view that advancements in the field of wind engineering have permitted many leading structures to be tested and analysed under controlled circumstances to develop information critical to their design and economics. "Initially, the concept and benefits of wind tunnel testing were difficult for the industry to grasp," he suggests. "This tool has become so valuable, however, that it has now become an accepted part of the design process for a wide variety of structures."

The 1984 opening of a new boundary layer wind tunnel building provided an integrated facility for all the activities of the BLWTL. The centrepiece of the installation is BLWT II, a new closed-circuit wind tunnel which offers significantly enhanced potential for R&D as well as improved operational effectiveness. The length, cross-sectional area and maximum wind speeds in BLWT II are all nearly double those of the original BLWT I. The closed circuit design gives both high speed and low speed test sections, each with its own unique characteristics.

The BLWT Laboratory has integrated objectives in three fundamental areas, says Dr. Davenport: research, education and applications. The interconnection of these areas is essential and Dr. Davenport sees an important role for industry to play in the mission of the BLWTL. "To be effective, both research and education require relevance," he explains. "In this, industry holds the key. If the research is relevant to needs, there will be feedback to test its quality; there will be a sense of accomplishment. What is more, relevance enhances the value of the research and education, both to industry and to the individual. It can create jobs and launch useful careers. It is synergistic."

Hence, the new industrial initiative. "We are looking for new applications to supplement our current program of activities, " says Dr. Davenport. "The economic benefits which result from testing and analysis can surely assist a wide variety of organizations while making effective use of the newly installed capabilities of BLWT II."

More information on the Boundary Layer Wind Tunnel Laboratory may be obtained by contacting Dr. Alan Davenport, Director, BLWTL, Faculty of Engineering Science, The University of Western Ontario, London, Ontario, N6A 5B9.

C-FER Fellows Featured at Special Symposia

C–FER Fellows Ben Gerwick and Alan Davenport will be front and centre at two special events now being planned as part of C–FER's networking initiative. Workshops and seminars are a key ingredient in the Centre's commitment to technology transfer and the sessions currently being planned are no exception.

The first C–FER Fellow Special Symposium is being planned as a part of POAC 87, the 9th international conference on Port and Ocean engineering under Arctic Conditions, being held at the University of Alaska-Fairbanks from 17 to 21 August. The one-day session will focus on Steel-Concrete Composite Structural Systems and will feature Ben Gerwick, internationally recognized consulting construction engineer from San Fransisco, California. Experts from Canada, the United States, Great Britain and Japan will join with Mr. Gerwick for an intense examination of the design and behaviour of composite structures. It is anticipated that one outcome of the symposium will be a series of recommendations for consideration in the development of standards.

The second C–FER Fellow Special Symposium will take place next November in London, Ontario. Featuring Alan Davenport, Director of the Boundary Layer Wind Tunnel Laboratory (BLWTL) at the University of Western Ontario, the session will focus on Environment, Design Criteria and Loads, with particular application to the proposed Canadian Standards Association Standard S471. Three separate but related half-day sessions will examine the key aspects of the preliminary standard. In each case, a panel of international experts will critique the session and lead in the development of recommendations for the consideration of the standards committee. A tour of the BLWTL will round out the two-day symposium.

In addition to the two C–FER Fellow Symposia, work is underway on two other C–FER sponsored seminars. The sixth in the series on Northern and Offshore Information Resources (NOIR) will be held in Toronto on 30 April in conjunction with the annual meeting of the Association of Canadian Universities for Northern Studies. Sponsored jointly by C–FER and the Arctic Institute of North America, the NOIR series has been held at various locations across Canada during the last eighteen months.

The fourth session currently on the network drawing board is to be held in collaboration with INTER-CAN '87, the 5th biennial international Canadian Offshore and Onshore Petroleum

Workshop Dates

Northern and Offshore Information Resources
April 30, 1987
Toronto, Ontario
In conjunction with the annual meeting of the Association of Canadian Universities for Northern Studies

Wear in the Oil Industry
June 3, 1987
Edmonton, Alberta
In conjunction with INTER-CAN '87

C-FER Fellow Special Symposium on Steel-Concrete Composite Structural Systems
August 20, 1987
Fairbanks, Alaska
In conjunction with POAC 87

C-FER Fellow Special Symposium on Environment, Design Criteria and Loads
November 3/4, 1987
London, Ontario

For more information , contact Elizabeth Clarke, C-FER Networking Officer, telephone (403) 432-5108.

Exhibition and Conference scheduled to be held in Edmonton, Alberta from 2 to 4 June. The half-day technical session sponsored by C–FER will be entitled Wear in the Oil Industry and will be of particular interest to oil producers and service companies. A wide range of wear problems will be reviewed including sucker rod/tubing wear; drill string/casing wear; wear problems in oil sand production; wear reduction; and well design considerations.

More information on any of the above workshops and seminars may be obtained by contacting Elizabeth Clarke, Networking Officer, telephone (403) 432-5108.

Corrado Comes to Campus

Joe Corrado, a civil engineer currently on leave from his position with the Structures Department of the David Taylor Naval Ship Research and Development Centre in Bethesda, Maryland, will be a guest of C–FER and the University of Alberta for two weeks in early February. Brought to campus under the terms of the University's Distinguished Visitor program, Dr. Corrado will be located at C–FER but will split his time between the Centre and the University's Faculty of Engineering.

Dr. Corrado will present two lecture series during his time on campus: the first on fracture, and the second on the use of composite materials. In addition, he will present several specialized lectures and will spend considerable time in discussion with both University faculty and graduate students and C–FER research engineers.

Dr. Corrado is a graduate of the University of Detroit (BCE 1963) and Lehigh University (MS 1965; PhD, Civil Engineering 1971). A structural engineer with broad experience, he worked in the Research Department/Electric Boat Division of General Dynamics Corp. before joining the David Taylor Naval Ship R&D Centre in 1971. He has since held positions in both its Ship and Submarine Technology Program and, more recently, in its Structures Department.

Cover Photo

Maurice Slack, C–FER research engineer, is shown taking ultrasonic reflection amplitude pressure (URAP) readings on an 89 mm premium tubing connection mounted in a large tubular load frame designed and constructed by C–FER as part of its research project on the development of techniques to evaluate contact pressures in tubular joints. In this test, the premium connection seal response to applied loads is being investigated through the use of the URAP measurement, a new stress analysis technique discovered by C–FER.

Collin to Head Planning Team

Arthur Collin, a member of the C–FER Board of Directors, has been appointed by Prime Minister Brian Mulroney to head the transition team planning the establishment of the new Canadian space agency as announced in last October's speech from the throne. In making the 24 December announcement, the Prime Minister said that the new agency is central to his government's commitment to foster science and technological excellence in Canada.

As director of the transition team, Dr. Collin will head the group of senior officials who will draft the legislation needed to give a legal framework to the space agency. He will also represent Canada's interests in negotiations with the Americans on all space-related projects including development of radar-based satellites for resource management, the participation of Canadian astronauts in the Challenger program and the multinational space station.

A career civil servant, Dr. Collin obtained his doctorate in marine sciences from McGill University in 1962. He has spent the last year as special adviser to Frank Oberle, Minister of State for Science and Technology. Prior to that, his varied responsibilities included a three-year term as Associate Deputy Minister of Energy, Mines and Resources Canada, and appointments as Assistant Deputy Minister, Atmospheric Environment Service; Assistant Deputy Minister, Ocean and Aquatic Sciences; Director General, Fisheries Research; and Dominion Hydrographer.

Co-op Student Hired

For the third year in succession, C–FER has brought on stream an engineering student via the University of Alberta's co-operative education program. Dan Shute, a fourth-year student in civil engineering, joined C–FER in January and will work at the Centre for two consecutive four-month work term placements.

A high academic ranking and considerable practical work experience make Dan an ideal candidate for the C–FER research team. A four-month stint as a field operator with Mobil Oil and, prior to that, another work-term placement at Syncrude have given him the right background for involvement in two of C–FER's research projects.

While at C–FER, Dan will divide his time between the Centre's research related to composite ice-resisting walls and that focussed on the development of techniques to evaluate contact pressures in tubular joints.

Proceedings Soon Available

Proceedings will soon be available for the 3rd Annual Arctic Offshore Technology Conference and Exposition, held last October in Calgary, Alberta. According to AOTC organizer Martin Keeley, the proceedings will be completed later this month and distributed to those who attended the week-long event. Copies will also be available for sale at that time. More information may be obtained by contacting MAK Communications, telephone (403) 242–4288.

Research in Progress

Offshore Structures

CSA Code for the Design, Construction and Installation of Offshore Structures. *Project Officer, Peter Adams.*

Response of Steel Members Under Various Loading Rates and Temperature Conditions. *Project Officer, Karen Baker.*

- Literature Review - Brittle Fracture: Mechanics, Testing and Design.

Toughness Characteristics and Corrosion Susceptibility of Welded Plate. *Project Officer, Bernie Luft.*

- Field Assessment of Weld Corrosion on MV "Arctic".*

Design and Behaviour of Composite Ice-Resisting Walls. *Project Officer, Tom Zimmerman.*

Development of Short Term Laboratory Tests to Evaluate Corrosion Susceptibility of Welds. *Project Officer, Raja Voruganti.*

Downhole Tubular Systems

Experimental Investigation of Make-up Procedures for Tubular Joints. *Project Officer, Maurice Slack.*

- Development Techniques to Evaulate Contact Pressures in Tubular Joints.

Sucker Rod/Tubing Wear in Deviated Wells. *Project Officer, Cam Matthews.*

Finite Element Analysis of Tubular Joints: Structural and Leakage Integrity. *Project Officer, Trent Kaiser.*

- Three Dimensional Finite Element Analysis of Threaded Connections.

Casing/Formation Interaction Model for Thermal Recovery Wells. *Project Officer, Terry Marion.*

Evaluation of X56 Casing Subject to Large Tensile Strains and External Pressures. *Project Officer, Duane DeGeer.**

* *Contract Research*

C-FER

Centre for Frontier Engineering Research

C-FER was established in 1983 with a grant from the Devonian Group of Charitable Foundations. The mandate of C-FER is to address problems related to the safe and economical development of Canada's frontier petroleum resources. *Frontiers* is published quarterly by C-FER. Announcements and articles of interest to its readership are welcomed.

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Editor: Elizabeth Clarke
Phone: (403) 432-5108

Centre for Frontier Engineering Research

Networker

A monthly update

February 1987

More than 40 representatives of Canada's energy industry met in early February in Edmonton to take part in a meeting focussed on C-FER's research project related to Sucker Rod/Tubing Wear in Deviated Wells. According to project leader Cam Matthews, a valuable information exchange took place among members of service companies, manufacturers of oil field production equipment and oil producers. A demonstration of the recently-completed C-FER Wear Test Machine was included in the day's agenda.

Energy, Mines and Resources Canada has reached an agreement with nine other countries to participate in an information exchange via the International Energy Agency's Energy Technology Data Base (ETDB). Included in the on-line service is information on fossel fuels, renewables, energy storage and conversion, end-use technologies, and advanced energy systems. Other countries involved in the energy R&D information exchange are the United States, Denmark, Sweden, the United Kingdom, Norway, the Federal Republic of Germany, Finland, Spain and the Netherlands. ETDB is accessible through Dialog Information Services, Mead Data Central or STN International in the United States. More information may be obtained by contacting Barbara Summers, Energy, Mines and Resources Canada, telephone (613) 995-9351.

Forensic Engineering is the title of a new international journal being published by Pergamon Journals. The quarterly publication has been designed to provide an avenue of public documentation by publishing material on the evaluation, analysis, investigation, presentation and history of structural failures. Editor-in-Chief of the new journal is Bruce A. Suprenant, University of South Florida. Co-editors are Robert Garrett, Garrett Engineers, Los Angeles, California; H.P. Rossmanith, Institute of Mechanics, Vienna, Austria; and Andrew Scanlon, University of Alberta, Edmonton, Alberta. The Editors are inviting papers on the business, legal, and technical aspects of failures. Technical subject topics include (but are not limited to) all types of structures, foundations, machinery, soil mechanics, geology, mining and materials. Papers should be sent to Bruce A. Suprenant, Editor-in-Chief, c/o the Department of Civil Engineering and Mechanics, University of South Florida, Tampa, Florida, 33620.

CFER

Papers are still being accepted for Subsea '87, the fourth in a series of conferences organized to provide an international forum for informed discussion of subsea engineering and new technology issues. Theme of the conference, which is scheduled to take place on 3-4 December, 1987 at the Heathrow Penta Hotel in London, England, is "Subsea Trends: For Shallow and Deep Water, For New Fields and Satellites." The deadline for title and 200-word abstracts is 15 April, 1987, with acceptance to authors by 31 May. Completed manuscripts are expected by 15 October. More information on Subsea '87 may be obtained by contacting the conference office at P.O. Box 2, Chipping Norton, Oxon, OX7 5QX, United Kingdom.

A new, one-year graduate level Marine Affairs Program has been established at Dalhousie University in Halifax, Nova Scotia. The multi-disciplinary program is intended to provide a comprehensive overview of the theoretical issues of ocean policy and management and their practical application to policy, law and marine resource developments. The program will provide students with a framework in which conflicting demands of users and jurisdictions can be considered. Co-ordinators for the program, which is co-sponsored by the International Centre for Ocean Development, are Ian Townsend-Gault, David VanderZwaag and Raymond Cote, all of Dalhousie University. More information may be obtained by contacting the Marine Affairs Program, Faculty of Law, Dalhousie University, Halifax, Nova Scotia, B3H 4H9, telephone (902) 424-3555.

"Mind, Heart and Vision — Engineering in Canada: The Next Hundred Years" is the theme chosen to mark the 100th anniversary of engineering as an organized profession in Canada. Activities and events are being staged across the country to celebrate and commemorate Canadian engineering achievements. One such event is being held in Calgary, Alberta on Tuesday, 24 February. Described as a "Gala Event in Commemoration of the First Annual Meeting of the Engineers of Canada 1887", the black tie event is being sponsored by the Engineering Institute of Canada in co-operation with the Alberta Engineering Centennial Committee. More information on this and other anniversary events may be obtained by contacting the AECC, telephone (403) 426-3990.

The Centre for Frontier Engineering Research was established in late 1983 to undertake research designed to foster the safe and economical development of Canada's frontier petroleum resources. *Networker* is published regularly by C-FER. Information of interest to its readership should be sent to:

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Centre for Frontier Engineering Research
C-FER Building
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C-FER

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Centre for Frontier Engineering Research

Annual Report 1985-86

C-FER's research portfolio contains two major programs: Offshore Structures and Downhole Tubular Systems. Represented on the cover are the five most active projects within these programs. Top diagonal row (left to right): composite ice-resisting walls; finite element analysis of tubular joints; and toughness characteristics and corrosion susceptibility of welded plate. Bottom diagonal row (left to right): sucker-rod/tubing wear; and evaluation of contact pressures in tubular joints. Background: a section of a rack of sample welds attached last summer to the exterior of Gulf's Molikpaq.

The Collaboration Continues

The Centre for Frontier Engineering Research is an incorporated, non-profit research organization located on the University of Alberta campus. Funding for the collaborative research centre is provided by the Devonian Group of Charitable Foundations, the Governments of Alberta and Canada, the University of Alberta and the private sector.

C-FER's research programs in offshore structures and downhole tubular systems have been designed to foster the safe and economical development of Canada's petroleum resources on both the geographical frontiers of the Arctic and offshore and the technological frontiers reflected in Alberta's enhanced recovery operations. The Centre's networking program acts as a switchboard, facilitating the movement of current technical information through Canada's frontier-related industries.

Dramatic decreases in the price of world oil have resulted in a climate of economic uncertainty and a necessary adjustment in the timing of frontier development. In spite of this, the prospect of continued support for C-FER remains high. The list of C-FER Members has nearly doubled since the beginning of the current year, clear recognition by Canada's industrial quarter that financial support for C-FER is a sound investment that will pay great dividends.

The confidence placed in C-FER by increasing numbers of Canada's energy and steel industries is most gratifying, particularly in light of today's economic instability. The challenge facing C-FER during the coming months is to build on that confidence, reinforce the importance of collaborative research and meet the immediate needs of industry without losing sight of C-FER's long-range vision. In this way, the momentum that has moved C-FER forward so successfully will continue.

Report of the Chairman and the President

The past twelve months have been productive and challenging ones for the Centre for Frontier Engineering Research. In spite of current economic uncertainties, we can look back on our second year of operation with great satisfaction. And we can look forward with considerable confidence, for the philosophy on which C-FER was established is based on two premises which are independent of economic fluctuations: first, that there is a very real need for specialized research in frontier engineering; and, second, that this research should be collaborative in nature.

Our first year was spent targeting research programs of major interest to our Members. Discussions held during that time led to the expansion of our research mandate to include work on both Offshore Structures and Downhole Tubular Systems.

Continued discussions this past year have helped us to initiate specific projects within these broad program areas which fit the requirements of our Member companies. We have talked to countless technical experts and managers in all levels of Canada's frontier energy industry. We have been encouraged to move with dispatch on certain projects, and have been advised of knowledge gaps which must be addressed.

We have made significant progress in our research. In our Offshore Structures program two major projects are of particular note. The welded plate project is designed to develop a reliable welding procedure suitable for either field repair or modifications of offshore structures and vessels. Our work during the past year has given us an increased understanding of the behaviour of structural joints welded at low temperatures. As a result, we are zeroing in on solutions to a problem of serious concern to industry. The composite wall project is one of our newer initiatives. It is focussed on the development of a design procedure for a new approach to the construction of ice-resisting exteriors on arctic structures. Work in this area has moved swiftly and is gaining increased interest from our Member companies.

"We have made significant progress in our research . . ."

Similarly, research in the Downhole Tubular Systems program reflects significant input from the energy industry. Discussions with those concerned with the performance of oil country tubular goods indicate that connection make-up is probably the weakest link in the chain of uncertainties leading to failure. As a result, two research projects were designed to assess the strength and leakage integrity of threaded connections, and work in both the finite element analysis and the experimental investigation is developing well. A relatively recent addition to the work in downhole tubulars is a project focussed on sucker rod/tubing wear in deviated wells. The addition of this project to the research portfolio is in direct response to industry's need for solutions to a problem brought about by an increased use of deviated and slant wells in the production of oil.

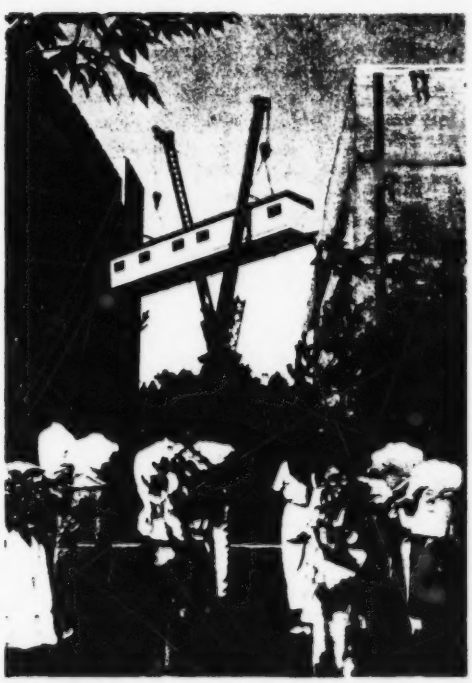
"The network is a critical component of C-FER's mandate . . ."

It has been most gratifying to experience the collaborative process in action; most satisfying to receive the on-going guidance of our many Member companies. Meetings of our Research Policy Committee, the Technical Council and individual project committees have resulted in the development of an overall research program that is innovative, flexible and immediate, one that is tailor-made to meet the needs of the industry we were designed to serve.

In the same way in which our research program has benefitted from a co-operative approach, so too has our networking initiative. The network is a critical component of C-FER's mandate. It acts as a switchboard, facilitating the movement of current technical knowledge through Canada's frontier-related industries. There is a two-fold advantage to this pivotal role. We have learned a great deal through the network in the past year; the information we have gathered has helped us keep our own research relevant and has helped us avoid redundancy. More importantly, it has enabled us to

be of increasing assistance to the industry, government and university communities that support us. For example, we have collaborated in the development of a seminar series which has been applauded across Canada. Our supporters have given us a consistent, clear message over the past year that information transfer is one of our most useful activities and we intend to continue this synergistic complement to our research activities.

The collaborative process is also in evidence closer to home. We are pleased to report that we have recently named our first two C-FER Fellows. Allan Davenport, Professor of Civil Engineering at the University of Western Ontario, is Director and founder of the Boundary Layer Wind Tunnel Laboratory. He has acted as an engineering consultant on many major structures, including the CN Tower in Toronto and the World Trade Centre in New York. Ben Gerwick, Jr. is a Professor of Civil Engineering at the University of California, Berkeley. He is internationally known as a consulting engineer, writer and educator responsible for numerous innovations and accomplishments related to the construction of marine structures and facilities. As C-FER Fellows, Dr. Davenport and Mr. Gerwick will act as technical advisors to C-FER's research programs, lending their considerable expertise to our work in offshore structures.



With the C-FER Building full to overflowing, trailers were installed on the roof of a nearby university carpark to house members of the C-FER research team.

"The overall group is a cohesive one, a mix of seasoned professionals and young enthusiasts . . ."

Our research staff has increased gradually during the past year. We now number 18 full-time staff; in addition, we have (as we had last year) two co-op students from the Faculty of Engineering working with us for an eight-month period. The overall group is a cohesive one, with a mix of seasoned professionals and young enthusiasts working well on our various research and networking initiatives. The real strength of C-FER lies with this group and we are indebted to them for their commitment.

The need for specialized lab facilities and a more permanent home for C-FER remains a fundamental issue. We are aggressively pursuing plans for a world class Test Facility which would incorporate a major low temperature structural laboratory and an impressive tubular products laboratory. Our discussions are continuing with government and industry representatives as we develop a plan which best meets the needs of our three support communities.

During the past year, two of our founding Directors, Lorne Leitch, the University of Alberta's Vice-President (Finance and Administration), and Bruce Simpson, Senior Vice-President, NOVA, An Alberta Corporation, completed their terms on the Board. We are grateful for their constant support and thoughtful advice and we thank them for it. We are pleased to welcome J. Gordin Kaplan, the University's Vice-President (Research), and George Miller, President, NOVA/Husky Research Corporation, as new Board members. Gordin and George are both well-known for their commitment to technology transfer and innovation in research; their presence on the Board will be most beneficial. The active involvement of all our Directors is a key to our progress during this past year. We are tremendously appreciative of the time and energy they have given to C-FER and we look forward to continued support from them.

We also acknowledge the ongoing support of the University of Alberta. Our office space and lab facilities on the U of A campus are complemented by the growing relationship that is developing with faculty and students alike. We have worked in tandem increasingly over the past year and have all benefitted from the co-operative effort.

In conclusion, we would like to express our gratitude to those in our Member companies. Our list of supporters has nearly doubled in the past year, with every new Member representing another vote of confidence in our Centre. It was particularly gratifying to learn at our final Board meeting of the fiscal year (a joint meeting with the Board of Governors of C-CORE, the Centre for Cold Ocean Resources Engineering), that our approach is seen to be the right one by our Member companies. In spite of the economic downturn, our Directors told us that they are, to a company, prepared to continue their support for research even in days of financial uncertainty. To have our mandate and *modus operandi* reinforced in this way is most rewarding. But we must not become complacent. With the world oil price low, the timing of investment in frontier development is increasingly uncertain. The reduction in income of the energy industry may yet be reflected in the dollars that can be set aside for research activities. In this light, the challenge facing C-FER is an immediate one.

"Our list of supporters has nearly doubled in the past year . . ."

We must first remind Canada's energy industry that research is a critical component of any successful venture; that an investment in research now will pay tremendous dividends in the future. Secondly, we must convince an increasing portion of the energy industry that financial support for C-FER will give them good, even exceptional, value for their dollar; that the research carried out at C-FER is leading edge and of such quality that it will make a significant contribution to the safe and economical development of Canada's frontier petroleum resources.

To be persuasive, we must make every effort to streamline our own research initiatives. We must put ourselves through a critical self-evaluation: we must reassess our priorities, become increasingly cost effective in our budget planning and be prepared to make some hard decisions about research priorities.

Peter Adams (left) and Ernie Pallister

This is a challenging task, and one that requires us to walk a fine line between long-term and short-term goals. We must be able to adjust our planning to meet the immediate needs of industry without losing sight of our long-range vision. It becomes a question of balancing fast results and future breakthroughs.

We have accomplished a good deal in the past 12 months. The niche we have carved out for C-FER is flexible and forward-looking. We have committed ourselves to a particular path and our momentum will continue to build as we move steadily in that direction. Now more than ever is the time for collaborative research ventures such as C-FER. With continued support from industry, government and universities in Canada, we shall no doubt continue as an innovative leader in that collaborative process.

A.E. Pallister
Chairman of the Board

P.F. Adams
President

C-FER Board of Directors*

Dr. A.E. (Ernie) Pallister
President
Pallister Resource Management Ltd.
(Chairman of the Board)

Dr. A.E (Art) Collin
Secretary
Ministry of State for Science and Technology
Government of Canada

Mr. J.E. (Ed) Czaja
Executive Vice-President
Shell Canada Limited

Mr. W.K. (Bill) Grundy
General Manager, Western Region
Stelco Inc.
(Chairman, Membership Committee)

Mr. R.O. (Ray) Jonasson
Director of Business Development
Canadian Group
Dominion Bridge, AMCA International

Dr. J.G. (Gordin) Kaplan
Vice-President (Research)
University of Alberta

Dr. G.B. (George) Miller
President
NOVA/Husky Research Corporation

Mr. M.B. (Murray) Todd
Senior Vice-President
Production and Development
Dome Petroleum Limited
(Chairman, Research Policy Committee)

Mr. I.E. (Ian) Williams
Group Sales Manager
Fabrication and Heavy Manufacturing
The Algoma Steel Corporation, Limited
(Chairman, Technical Council)

* April 1, 1986

The C-FER Board of Directors met three times during the 1984-85 year. The June, 1984 meeting was held in Edmonton, Alberta. Special guests to the meeting were Ken Broadfoot, Assistant Deputy Minister, Alberta Economic Development; Gerry Ewing, Assistant Deputy Minister, Department of Fisheries and Oceans; and Sami Mohsen, Acting Director, Boreal Institute for Northern Studies. The October, 1984 meeting took place in Hull, Quebec. Special guests were Clair Callaghan, President, Technical University of Nova Scotia; Bill Erickson, Director, Physical Metallurgy Research Laboratory, CANMET; Jim Harrison, Chairman, Science Institute of the Northwest Territories; Ross Pottle, Vice-President, National Research Council; and Hermann Steltner, Director, Arctic Research Establishment. The final meeting of the year was a joint meeting of the C-FER Directors and the C-CORE Board of Governors held in Calgary in March, 1985.

C-FER Staff

Peter Adams
President

Tom Collier
Vice-President, Administration

Larry Staples
Vice-President, Research

Elizabeth Clarke
Networking Officer

Karen Baker
Duane DeGeer (1984)*
Kevin Humphreys
Darlene Hyrve
Trent Kaiser
Bernie Luft
Marlene Martz (1984)*
Cam Matthews
Krys Mouw
Ulli Pietsch (1985)*
Dave Playdon
Maurice Slack
Iwona Smuga-Otto
Richard Witzke
Raja Voruganti
Steven Young (1985)*
Geoffrey Yue
Tom Zimmerman

* Co-op Engineering Students

Research Report

Murray Todd, Chairman, Research Policy Committee

The technical expertise of C-FER is based on the combination of sophisticated analysis, large scale lab testing and field benchmarking of results. C-FER is uniquely suited to work in the middle ground between the curiosity-motivated research of universities and the problem solving carried out daily by industry. Initially, this expertise was applied to Offshore Structures, primarily those designed for the Beaufort Sea. Identification by several Member companies of important and costly problems related to Downhole Tubular Systems led to the creation of a second research program focussed in that general field. The commonality between the two programs is that both structures and tubulars are subjected to very high loads under extreme (albeit very different) environmental conditions.

The process of research project selection has undergone considerable growth during the past year. Overall financial stewardship, including the disposition of the Research Trust Fund, lies with the Board of Directors. Development of corporate policy and the establishment of broad direction for research programs is the responsibility of the Research Policy Committee. Under the chairmanship of Murray Todd, Dome Petroleum, the Committee has met at four-month intervals in order to advise the Board. Serving with Mr. Todd on the Committee are the following representatives of C-FER Member companies: Art Collin, Ministry of State for Science and Technology; Dave Fleming, Shell Canada Limited; John Hood, Stelco Inc.; John Loh, Gulf Canada Corporation; and Ian Williams, The Algoma Steel Corporation, Limited.

"C-FER's research is industry driven and industry directed . . ."

Acting in concert with the Research Policy Committee is the C-FER Technical Council. Chaired by Algoma's Ian Williams, the Council is comprised of technical experts from each Member company. It is responsible for reviewing project proposals, assessing project mix within each program, and judging the overall effectiveness of each program. The Technical Council met twice during 1985/86, once to consider Downhole Tubular Systems, and once to consider Offshore Structures.

The Technical Council is supplemented by a series of individual project committees comprised of Member experts interested in a specific project. These small committees meet on an "as necessary" basis to advise C-FER project officers on project effectiveness, formulation of results for best effectiveness, etc. During the past year, project committees have convened for each of the five most active projects.

In conjunction with the project committees, an extensive monthly reporting system has been developed, with concise summaries of project activity and preliminary results submitted monthly to technical experts in C-FER's Member organizations. In this way, interested individuals are kept abreast of both research progress and initial results. There is great synergy between these developments and C-FER's strong commitment to networking, with ideas and initiatives circulating through Member companies, C-FER staff, and approximately 800 network contacts across Canada.

Efforts are continuing at C-FER Atlantic, on the campus of the Technical University of Nova Scotia, to develop both research and networking initiatives which address problems unique to the east coast offshore. Drs. Graeme Lee and Keith Leewis, TUNS research engineers, have contributed much of their research time this past year to incubating the fledgling satellite office. Closer to home, co-operation continues between C-FER and the University of Alberta. Research focussed on global ice loads, corrosion and welding, composite ice walls and numerical modelling of threaded joints are but some of the areas in which C-FER has benefitted from the expertise and co-operation of university faculty.

In sum, strong and direct technical linkage with C-FER Members has been established to identify, initiate and guide research which will have technical and economic impact. Information is flowing quickly and freely to those individuals who can put the knowledge to work. This is substantial progress in the development of an industry-driven research centre.

Research in Progress

The sidebar lists all those research projects in both Offshore Structures and Downhole Tubular Systems that have been addressed with varying degrees of activity during the 1985/86 year. The five principal projects are summarized below; the others were

Research in Progress

Offshore Structures

CSA Code for the Design, Construction and Installation of Offshore Structures.

Response of Steel Members Under Various Loading Rates and Temperature Conditions.
- Literature Review – Brittle Fracture: Mechanics, Testing and Design.

Toughness Characteristics and Corrosion Susceptibility of Welded Plate.
- Seawater Corrosion Weldments.
- Field Assessment of Weld Corrosion on M.V. "Arctic".*

Dynamic Characteristics of Ice Loading.
- Analysis of 1983 Hans Island Ice Loading Data.*

Design and Behaviour of Composite Ice-Resisting Walls.

Enhanced Analytical Methods for Offshore Structures.
- Finite Element Analysis of SSDC Steel Mat.*

Development of Short Term Laboratory Tests to Evaluate Corrosion Susceptibility of Welds.
- Development of Electrochemical Techniques and Correlation between Various Tests for Evaluation of Weldment Susceptibility to Preferential Corrosion.

Downhole Tubular Systems

Downhole Tubular Products: Literature Review, Problems and Products Overview.

Experimental Investigation of Make-up Procedures for Tubular Joints.
- Development Techniques to Evaluate Contact Pressures in Tubular Joints.

Sucker Rod/Tubing Wear in Deviated Wells.

Finite Element Analysis of Tubular Joints: Structural and Leakage Integrity.

Assessment of Detailed Structural Design Procedures for Casing Systems.

* *Contract Research*

Keith Clegg, National Research Council (left), and C-FER Director George Miller, NOVA/Husky, examine a C-FER test set-up.

pursued on an "as time permits" basis. The three listed as contract projects were undertaken on a proprietary basis for various reasons: to enhance C-FER's expertise or gain exposure to certain data; to broker together an industry need with special expertise at the University of Alberta; or to undertake collaborative research with other performers.

Offshore Structures

Toughness Characteristics and Corrosion Susceptibility of Welded Plate

Firms that design and operate equipment and structures in harsh arctic marine environments have considerable interest in fracture and corrosion resistance of field welds made at low ambient temperatures. The objective of this project is the development of a repair welding procedure for certain arctic grade marine steels, for −30°C temperatures without pre or post heating. A mechanically sound, adequately tough, adequately corrosion resistant weld has been achieved; testing is continuing to optimize the technique and provide background for certification of the procedure.

Mathieu Mattz, one of the Centre's first co-op engineering students, assists in the preparation of a rack of weld specimens prior to its installation on the side of the Gulf Molikpaq. The rack will assist in the generation of information on corrosion aspects of the welded plate project.

Tom Zimmerman (right) explains details of C-FER's composite ice-resisting wall project to Murray Todd, Chairman of the C-FER Research Policy Committee (left), and Ian Williams, Chairman of the Technical Council.

Design and Behaviour of Composite Ice-Resisting Walls

Composite, steel/concrete sandwich walls have been proposed as a cost effective means of resisting the high ice loads experienced by the exterior of Beaufort Sea production structures. The objective of this project is to make recommendations regarding methods of analysis and design, effective construction details and optimum sizes. Several finite element models have been assessed with regard to their ability to accurately predict physical behaviours, and the first two (of fifteen) large-scale specimens have been tested in the laboratory.

Downhole Tubular Systems

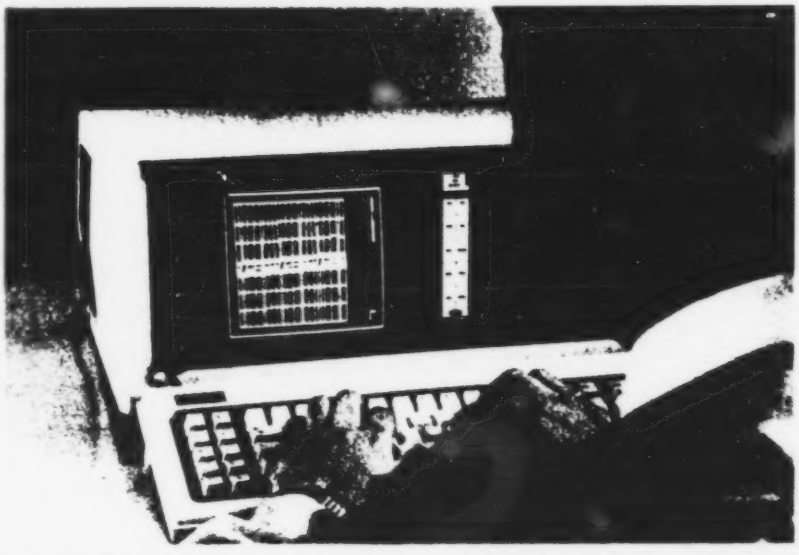
Finite Element Analysis of Tubular Joints—Structural and Leakage Integrity

Threaded connections in casing or tubing strings are the major contributors to failures of downhole tubular systems. The objective of this project is the development of a numerical modelling procedure which accurately predicts physical behaviour of a joint in high stress and near failure conditions. An axisymmetric model has been developed and debugged, and has been benchmarked against makeup stresses measured in the companion contact pressures project.

Sucker Rod/Tubing Wear in Deviated Wells

Significant increases have recently occurred in the use of curved wells for heavy oil recovery and to achieve pad drilling economics: contact between sucker rod and production tubing can lead to premature component wear failures. The objective of this project is to develop an understanding of the relative importance of various parameters on wear rates. This will be accomplished through a field study to collect data currently scattered among many operators, and through design and construction of a large-scale test apparatus capable of assessing actual components. Conceptual design of the apparatus is ongoing to develop a cost-effective configuration, and the field study will be initiated in mid-1986.

Cam Matthews, project leader of the sucker rod/tubing wear research, cuts open a coupling for inspection and evaluation (above). Maurice Slack (right) readies the test apparatus designed to measure seal surface contact pressures.



The ADINA program, made available to C-FER by the U of A Department of Civil Engineering, is used for the finite element analysis of tubular joints.

Development of Techniques to Evaluate Contact Pressures in Tubular Joints

To reduce problems and in-service failures of threaded joints, tighter control on connection makeup procedures is desirable. The objective of this project is to develop a technique which can measure directly actual seal surface contact pressures, the key variable in proper makeup. A parallel objective is accumulation of physical measurements against which to benchmark the finite element model of tubular joints. Feasibility has been verified for a technique using ultrasonic reflection amplitudes, and work is continuing to refine the methodology and develop a calibration curve.

Membership Committee

Bill Grundy, Chairman of the C-FER Membership Committee (right), confers with committee member Ed Czaja.

The responsibility for attracting Members to C-FER lies in large measure with the Membership Committee, a standing committee of the Board of Directors. Chairman of the Membership Committee is Bill Grundy, Stelco Inc. Initially serving with him on the Committee were Ed Czaja, Shell Canada Limited, and Bruce Simpson, NOVA, An Alberta Corporation. Mr. Simpson completed his term on the Board during the year and was replaced on the Membership Committee by C-FER Director Ray Jonasson, AMCA International.

The initial task of the Membership Committee was to set in place a mechanism for determining appropriate levels of funding from the wide range of industry, government and university support groups, and to define a package of benefits appropriate to Membership in C-FER. This past year, three formal meetings of the Committee took place, focussed on a variety of additional issues related primarily to the enhancement of C-FER's private sector support. Issues considered by the Committee include member categories, foreign membership, core versus contract funds, increased collaboration with affiliated research centres, patents and ownership information.

A major effort of the Committee this year has been a strengthening of its approach to Member solicitation through increased discussions with potential Member companies concerning the specific advantages of C-FER Membership. This effort has borne fruit, with a steady and substantial increase in private sector support having accrued this year. This is particularly gratifying in light of the uncertain economic environment of the past few months. In the past 12 month period, the list of C-FER Members has nearly doubled, with annual contributions from the private sector alone now totalling nearly $500,000 (in-kind support included). This is an encouraging sign for, while the initial grant from the Devonian Group has given C-FER a healthy and secure start, the Centre's long-term viability depends on increased commitment from those industries with a particular interest in the development of Canada's frontier related activities.

"There has been a steady and substantial increase in private sector support . . ."

In return for that commitment, Members of C-FER receive a variety of benefits, the chief of these being the opportunity to influence the path of C-FER's core research programs and early access to research results.

C-FER Members

Consulting Companies
EBA Engineering Consultants
The Engineers Collaborative
GEOTECHnical resources
Hanson Materials Engineering
Kasten, Eadie Engineering
Stanley Associates Engineering
Swan Wooster Engineering
Viatec Resource Systems

Energy Companies
Bow Valley Industries
Dome Petroleum
Esso Resources Canada
Gulf Canada
NOVA, An Alberta Corporation
Petro-Canada Resources
Shell Canada
Syncrude

Foundations
Devonian Group of Charitable Foundations

Governments
Alberta Oil Sands Technology and Research Authority
Government of Alberta
Government of Canada
Energy, Mines and Resources
Regional Industrial Expansion
National Research Council

Petroleum Service Companies
Computalog Gearhart
Diversified Drilling Services

Steel Fabricators
AMCA International

Steel Producers
Algoma Steel
Stelco

Universities
Technical University of Nova Scotia
University of Alberta

Membership Benefits

- direct access to C-FER research staff
- advance knowledge of research in progress and of preliminary and final results
- eligibility for membership on the C-FER Board of Directors and its various standing committees
- membership on the C-FER Technical Council (a panel of industry experts who provide critical assessment of and future direction for specific research projects) and on its project committees
- preferred access to C-FER for the purposes of contract research
- preferred consideration for C-FER research subcontracts
- priority access to C-FER's information services
- access to all C-FER publications including confidential reports, technical papers (at reduced cost) and newsletters
- preferred cost and registration at all C-FER sponsored workshops, seminars and conferences

Networking Report

The seminar series on Northern and Offshore Information Resources was held four times during the past year and drew more than 300 delegates.

A commitment to the fostering of technology transfer has been seen as an important part of the C-FER mandate from the beginning of the Centre's development. As a result, considerable resources have been allocated both through a contract with Energy, Mines and Resources Canada and from C-FER's core operating budget for an intensive networking activity which exemplifies C-FER's commitment to collaboration.

The network has a dual role. Its primary function is to act as a switchboard, facilitating the movement of current technical information among industries, governments and universities in Canada with a specific interest in C-FER's research programs in offshore structures and downhole tubular systems. A second purpose of the network is to act as a listening post and thereby assist C-FER in keeping its own research on target.

The network is comprised of several interlocking components, the chief of these being person-to-person contact with hundreds of leading technical specialists in Canada's frontier-related industries . . . designers, fabricators, welders, shipbuilders, contractors, government regulators and university researchers. Many of these contacts were established during C-FER's first year of operation. While the network has continued to expand this year, a major effort has been extended towards maintaining contact with the existing group in order to stay tuned to the changing needs of industry and, further, to remind industry of the role that C-FER can play in meeting these needs. As C-FER's research in the area of downhole tubulars increases, so the network will expand to reflect that added dimension. Person-to-person contact is an indispensible part of the overall network initiative. It is one that requires significant time and effort on the part of the networking team, but the dividends that accrue make it a sound investment.

"The network facilitates the movement of current technical information . . ."

A second aspect of the network which has again proven to be a most useful mechanism for information sharing is the role of C-FER sponsored workshops and seminars. In addition to running several technical workshops, a major initiative in this area has been the development of a joint seminar series on Northern and Offshore Information Resources. Co-sponsored by C-FER and the Arctic Institute of North America, the NOIR seminar has been held in Calgary, Ottawa, Halifax and Yellowknife, and has brought together more than 300 information specialists and end users for a productive exchange of ideas related to the retrieval and dissemination of northern and offshore information. Plans are underway to continue the NOIR series at appropriate locations in Canada and, possibly, the United States. In addition, C-FER and the Arctic Institute are currently preparing a joint summary of proceedings of the seminar series, a major effort which will result in a valuable directory of information resources. The joint seminar series is an excellent example of the value of collaboration that underlies the philosophy of the C-FER network.

Several other activities of the networking program are worth mentioning. The newsletters have proven to be of continuing value, not just in telling the C-FER story but, equally important, in acting as a vehicle for information concerning initiatives taking place in Canadian industries, governments and universities. There has been an increasing call from both Member companies and network contacts to include such information in *Frontiers*, the quarterly forum, and *Networker*, the monthly update.

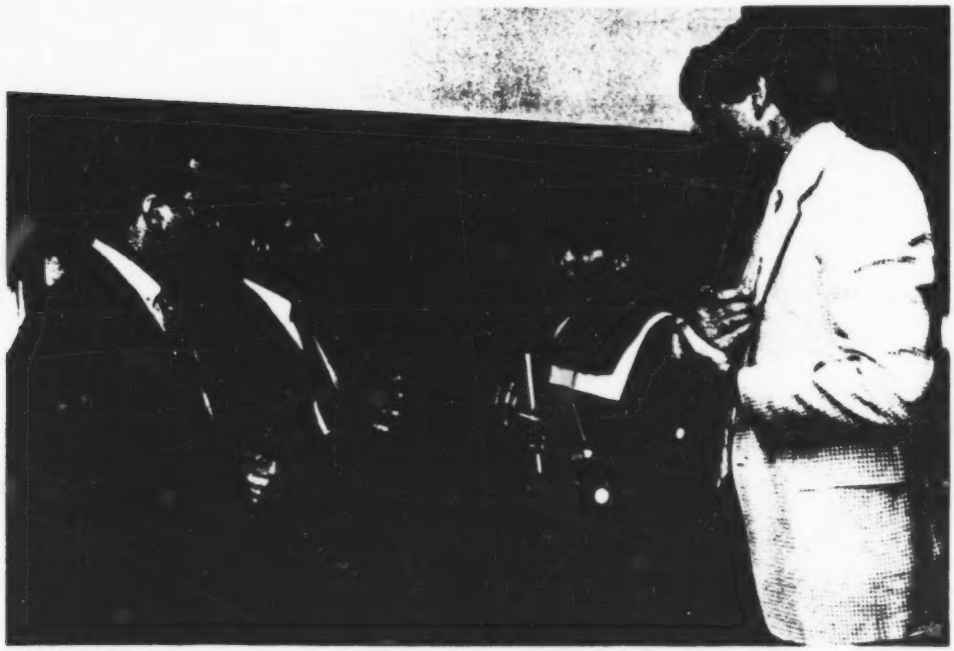
Also of note is the addition to the networking team of a part-time librarian whose primary responsibility is the acquisition and abstracting of material appropriate to C-FER's small, specialized library collection. In addition, her capabilities as a resource specialist are of increasing value not only to C-FER research engineers but also to those in both Member and network companies.

Collaboration continues with many affiliated research centres, particularly the Arctic Institute of North America, the Boreal Institute for Northern Studies, the Centre for Cold Ocean Resources Engineering, the Welding Institute of Canada and, most recently, the newly established Science Institute of the Northwest Territories.

An important benchmark for the network this year was an audit of the first 18 months activities. A small group of experienced professionals from various C-FER Member companies gathered with the networking team to provide external feedback on activities to date. The reviewers were: Keith Glegg, Vice-President, Technology Transfer, National Research Council of Canada; Alex Hemstock, Past President, Canadian Council of Professional

Engineers; Trevor Jubb, Deputy Director General, Physical Metallurgy Research Laboratory, CANMET; Jock McKay, Director, Research and Development, Stelco Inc.; and Ian Williams, Group Sales Manager, Fabrication and Heavy Manufacturing, The Algoma Steel Corporation Limited. Thoughtful and challenging comments provided by the participants made the audit an extremely useful activity, one that made a significant contribution to the overall review of the networking program goals and objectives.

Enhanced information sharing is the primary goal of the C-FER network. Indications to date are that this is recognized as a useful role. To achieve durability, the network must continue to listen closely to its constituent groups and must continue to adapt as needs change. C-FER is committed to this process and has been encouraged by the knowledge that those within the network appear to share this commitment. It is this philosophy of collaboration on which the network was founded, and which will carry it forward as an integral part of C-FER's mandate.



Members of the networking team talk shop with reviewers at the audit held last fall to evaluate networking activities of the first 18 months.

Auditor's Report

To the Members of the
Centre for Frontier Engineering Research Institute

I have examined the balance sheet of the Centre for Frontier Engineering Research Institute as at March 31, 1986 and the Operating Account and Research Trust Fund statements of income, expenditure and unexpended funds for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Centre as at March 31, 1986 and the results of its operations for the year then ended in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Donald D. Salmon C.A.
Auditor General

Edmonton, Alberta
May 16, 1986

CENTRE FOR FRONTIER ENGINEERING RESEARCH INSTITUTE
BALANCE SHEET
AS AT MARCH 31, 1986

	1986	1985
Assets		
Current:		
Cash	$ 66,149	$ 2,496
Deposits in trust with the University of Alberta (Note 5)*	762,486	801,479
Term deposits	50,000	100,000
Accrued interest	6,114	1,408
Accounts receivable	110,558	11,121
Prepaid expenses	340	—
	995,647	916, 504
Fixed:		
Furniture and equipment, at cost	19,605	7,195
Less: Accumulated depreciation	7,392	2,158
	12,213	5,037
	$ 1,007,860	$ 921,541
Liabilities and Equity		
Current:		
Accounts payable	$ 72,664	$ 47,681
Share capital (Note 6)	3	2
Unexpended Funds, Operating Account	60,510	71,587
Unexpended Funds, Research Trust Fund	874,683	802,271
	$ 1,007,860	$ 921,541

* The accompanying notes are part of these financial statements.

CENTRE FOR FRONTIER ENGINEERING RESEARCH INSTITUTE
OPERATING ACCOUNT
STATEMENT OF INCOME, EXPENDITURE AND UNEXPENDED FUNDS
FOR THE YEAR ENDED MARCH 31, 1986

	1986	1985
Income		
Transfer from Research Trust Fund	$ 997,972	$ 329,924
Contract fees	140,000	217,372
Interest	11,483	11,908
Sale of publications	455	—
	1,149,910	559,204
Expenditure		
Salaries and benefits	727,513	409,163
Administrative costs	172,302	119,125
Materials and supplies	118,135	7,875
Travel	62,648	54,303
Equipment, laboratory and rentals	21,709	12,511
Promotion and publications	18,916	27,929
Computer	15,274	3,533
Outside consultants and services	13,061	44,893
Recruitment and relocation	11,429	627
Research project costs, Schedule 1 (Note 7)	1,160,987	679,959
Excess of income over expenditure for the year	(11,077)	(120,755)
Unexpended funds at beginning of year	71,587	192,342
Unexpended funds at end of year	$ 60,510	$ 71,587

CENTRE FOR FRONTIER ENGINEERING RESEARCH INSTITUTE
RESEARCH TRUST FUND
STATEMENT OF INCOME, EXPENDITURE AND UNEXPENDED FUNDS
FOR THE YEAR ENDED MARCH 31, 1986

	1986	1985
Income		
Contribution from the Province of Alberta (Note 8)	$ 376,000	$ 376,000
Contribution from the Devonian Group of Charitable Foundations (Note 9)	200,000	200,000
Contributions from industry	194,000	101,000
Contribution from the Government of Canada (Note 10)	180,000	—
Contribution from the National Research Council of Canada (Note 11)	50,000	—
Contribution from the University of Alberta (Note 12)	27,972	29,924
Interest	42,412	44,992
	1,070,384	751,916
Expenditure		
Transfer to Operating Account	997,972	329,924
Excess of income over expenditure for the year	72,412	421,992
Unexpended funds at beginning of year	802,271	380,279
Unexpended funds at end of year	$ 874,683	$ 802,271

Approved by the Board

Director

Director

CENTRE FOR FRONTIER ENGINEERING RESEARCH INSTITUTE
NOTES TO THE FINANCIAL STATEMENTS
MARCH 31, 1986

Note 1: Authority

The Centre for Frontier Engineering Research Institute was incorporated on November 7, 1983 under the provisions of Part 9 of the Companies Act of Alberta to conduct research related to materials, fabrication processes, and other facilities required for energy-related developments in the Arctic, offshore and other Canadian frontier regions.

Note 2: Significant Accounting Policies

(a) The costs of various services provided without charge by the University of Alberta, Dome Petroleum Limited, the Natural Sciences and Engineering Research Council, the Government of Canada, and by the Technical University of Nova Scotia have not been included in these financial statements (Notes 12 and 13).

(b) Furniture and equipment are depreciated using the reducing balance method at a rate of 30%.

Note 3: Changes in Financial Position

A statement of changes in financial position is not provided as disclosure in these financial statements is considered to be adequate.

Note 4: Relation to the University of Alberta

The University of Alberta is a Member of the Centre for Frontier Engineering Research Institute (C-FER) and appoints one member of the Centre's Board of Directors. The University is also the owner of C-FER's building and certain equipment. These assets are not disclosed in these financial statements. In the event that C-FER is terminated, facilities and equipment provided or acquired for C-FER shall remain the absolute property of the University.

Note 5: Deposits in Trust with the University of Alberta

In accordance with the terms of agreements between the Centre and the Province of Alberta, and between the Centre and the Devonian Group of Charitable Foundations, contributions to research programs are deposited for credit to the Research Trust Fund. This Fund is administered by the Comptroller of the University of Alberta as trustee.

Note 6: Share Capital

Authorized capital: 20,000 shares without nominal or par value.

Issued capital: 3 shares at $1 each.

Note 7: Manpower Grants

Research project expenditures for the year ended March 31, 1986 have been reduced by $10,730 ($1985 - $10,400). This reduction represents funds received from the Province of Alberta, Department of Manpower $6,780 (1985 - $9,350) and the Government of Canada National Industrial Training Program $3,950 (1985 - $1,050).

Note 8: Contribution from the Province of Alberta

The contribution from the Province of Alberta was received from the Department of Economic Development under the terms of an agreement between the Centre and the Province of Alberta. The agreement provides for the Centre to receive funding in the amount of $376,000 per year until January 31, 1988, subject to certain restrictions.

Note 9: Contribution from the Devonian Group of Charitable Foundations

The contribution from the Devonian Group of Charitable Foundations was received under the terms of an agreement between the Centre and the Group providing for total funding of $2,500,000 over a five year period, subject to certain restrictions.

Note 10: Contribution from the Government of Canada

The contribution from the Government of Canada was received under the terms of an agreement between the Centre and the Government of Canada providing for total funding of $1,000,000 over a five year period, subject to certain conditions.

Note 11: Contribution from the National Research Council of Canada (NRC)

The contribution from the National Research Council of Canada was received under the terms of a contribution agreement between the Centre and NRC providing for funding of $50,000 for the year ended March 31, 1986. The agreement is eligible for annual renewal.

Note 12: Services and Contribution provided by the University of Alberta

Management has estimated the cost of various services provided without charge by the University of Alberta at $35,055 (1985 - $51,372) for the year ended March 31, 1986. In addition, the University made a cash contribution to the Centre.

Note 13: Services provided by Others

Management has estimated the cost of services provided without charge by other Member organizations at $293,500 (1985 - $70,000) for the year ended March 31, 1986.

Note 14 Comparative Figures

The 1985 figures have been reclassified where necessary to conform to 1986 presentation. Comparative figures are not provided for Schedule 1 because some projects are completed within the fiscal year.

Note 15 Approval of Financial Statements

These financial statements were approved by management.

Schedule 1

CENTRE FOR FRONTIER ENGINEERING RESEARCH INSTITUTE
SCHEDULE OF RESEARCH PROJECT COSTS
FOR THE YEAR ENDED MARCH 31, 1986

Networking	$ 329,280
Downhole Tubulars	183,539
Welded Plate	168,679
Structural Concepts	150,718
New Projects	138,673
Test Facility Cold Chamber	67,552
Ice Loading	62,613
C-FER Atlantic	59,933
	$ 1,160,987

C-FER

Centre for Frontier Engineering Research

C-FER Building
University of Alberta Campus
Edmonton, Alberta
T6G 2E2

Telephone: (403) 432-5108
Telex: 037-2966

TITLE Ice-structure interaction of an offshore platform

AUTHOR Powell, G.; Schricker, V.; Row, D.; Hollings, J.; Sause, R..

SOURCE Proceeding of the Conference Arctic '85 : Civil Engineering in the Arctic Offshore, March 25-27, 1985, San Francisco, California. - New York. : ASCE, 1985, [p. 230-238], ill. References.

LOCATION C-FER C00002

SUBJECT CIVIL ENGINEERING. ARCTIC. OFFSHORE

ANNOTATION Realistic estimation of the effects of ice floe impact is desirable for the design of certain subarctic offshore structures. The results of a preliminary study on dynamic ice-structure impact are described, for a large ice floe striking a tubular steel platform. The ice is modeled taking into account strain rate effects. A simplified model is used for the platform stucture, to reduce computational effort. Comparisons are made of the results obtained from both static and dynamic analyses. It is concluded that the static and dynamic results can generally not be correlated, and hence that the dynamic analysis is desirable.

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TITLE Iceberg interactions with offshore structures

AUTHOR de St. O. Isaacson, M..

SOURCE Proceedings of the Conference Arctic '85 : Civil Engineering in the Arctic Offshore, March 25-27, 1985, San Francisco, California. - New York. : ASCE, 1985, [p. 276-285], ill. References.

LOCATION C-FER C00002

SUBJECT CIVIL ENGINEERING. ARCTIC. OFFSHORE

ANNOTATION This paper reviews various aspects of the general problem of iceberg interaction with offshore structures. This includes the component problems corresponding to iceberg drift in open water, wave-induced motions of a berg, and the impact of an iceberg with an offshore structure. For smaller ice masses,

the effect of a large structure on the berg's trajectory, as well as the wave-induced motions of a berg, both are important problems which have received relatively little attention. The greatest difficulties in force and motion predictions are due to uncertainties in iceberg configurations and in ice properties, rather than due to the simulation of the physical processes involved.

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TITLE Icebreakers: Labrador, Ikaluk and sister ship Miscaroo, d'Iberville, Norman McLeod Rogers, John Cabot

AUTHOR Anon.

SOURCE Anon

LOCATION C-FER E00025

SUBJECT SHIPS. VESSELS. SPECIFICATIONS. LABRADOR. IKALUK. MISCAROO. D'IBERVILLE. NORMAN MCLEOD ROGERS. JOHN CABOT. ICEBREAKERS

ANNOTATION This reprint is a combination of various pages describing the various icebreakers with the following information shown for each: displacement, measurement, dimensions, aircraft, main engine, builders, date commissioned and some have photographs.

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TITLE Implications of ice ridges and rubble fields on the design of arctic offshore structures

AUTHOR Croasdale, K.R..

SOURCE Workshop on Sea Ice Ridging & Pile-Up, October 22-24, 1980, Calgary, Alberta. : NRC Tech. Memo 134, figures, tables. References.

LOCATION C-FER E00030

SUBJECT ICE RIDGES. ICE RUBBLE. OFFSHORE. STRUCTURES. DESIGN

ANNOTATION This paper reviews how ice ridges and ice rubble fields can affect ice forces on offshroe structures. The mechanism of ridge building as a limiting force is also reviewed. For narrow structures, it is suggested that thick multi-year ridges will govern the maximum ice forces. For wide

CENTRE FOR FRONTIER ENGINEERING RESEARCH

PROJECT MONTHLY REPORT

NOVEMBER, 1986

SUCKER ROD/TUBING WEAR IN DEVIATED WELLS

1. A project update was presented at the Downhole Tubular Technical Council Meeting which was held on November 19 in Calgary.

2. Installation of the fluid system for the wear testing machine has been completed and the second drive unit finally arrived and has since been installed. All four test units are now operational and a short term debugging program has been initiated.

3. The 1.69 inch OD standard steel couplings to be used in the first wear test series were supplied by Stelco while the tubing specimens were cut from 3.5 inch J55 ERW tubing manufactured by IPSCO. The tubing specimens were cut and installed such that the weld seam and heat affected zone will not be a factor in the initial wear tests.

4. The application of standard ultrasonic thickness measurement techniques to measure the wear of the tubing specimens at periodic intervals during the wear tests was investigated. The instrumentation that was used provided extremely accurate and repeatable results with individual thickness readings to $\pm$.001 of an inch.

   Since the ultrasonic thickness measurement technique was both practical aand reliable, it will be used as one method of monitoring tubing wear. On that basis, the initial condition of the tubing specimens was established by taking thickness measurements at a number of points along each wear section.

PREPARED BY: C.M. Matthews DATE: December 8, 1986
PROJECT NO. 85-13

FOR MORE INFORMATION PLEASE CONTACT THE C-FER PROJECT OFFICER, C.M. Matthews, AT 403 432-5108.

C-FER ATLANTIC BUSINESS PLAN
OCTOBER 1986 - MARCH 1987

1.0 HISTORY OF C-FER ATLANTIC

An agreement between the Technical University of Nova Scotia and the Centre for Frontier Engineering Research was reached on May 10, 1985 to establish a collaborative research operation on the TUNS campus. During the past year efforts to secure project work have culminated in the presentation of a proposal to NSERC for funding of a project to perform research into wear resistant coatings for the offshore industry. The proposal is currently being assessed by NSERC. Efforts continue to secure other reesearch work.

2.0 MANDATE OF C-FER ATLANTIC

To secure research projects in the areas of structural, metallurgical and welding engineering as they relate to the construction and use of structures in Canada's Arctic and offshore regions.

To provide technical expertise to local Members and industry generally.

3.0 OBJECTIVES

Undertake Research
Promote Networking
Provide Technology Transfer

4.0 GOALS

4.1 **To Initiate Three Projects**

Two have been identified at present:

(a) Wear Resistant Coatings

Program to be carried out over 18 months. Hire 1 technician, 1 graduate student. Obtain NSERC funding for consumables, staff, testing equpment.

(b) Electromagnetic Detection Procedure Development

Hanson Materials Engineering wishes to pursue certification by CGSB of the process. Requires procedure development and lobbying of Government regulatory bodies. Hanson is willing to invest in the leg work and fund a majority of the effort

4.2 **To secure $175,00 in Funding**

$100,000 from Federal Government (NSERC)
$ 50,000 from Provincial Government
$ 25,000 from private industry

4.3 **To Obtain two New Member Companies**

4.4 **To Develop the Following Concepts for Potential Projects:**

a) Expert system for rig management
b) Corrosion monitoring system using research work of Dr. Hsiung (TUNS)
c) Anchor chain defect acceptance criteria (in association with Hanson Materials Engineering)
d) Guidelines for casing design

5.0 UNDERLYING ASSUMPTIONS

Bow Valley Offshore does not leave the East Coast for at least one year.

Significant interest in the use of Electromagnetic Detection for inspection of marine structures can be generated both in Government and industry.

M & M Manufacturing continues to obtain contracts from out of province as well as maintain it's position as a major contractor for the local refineries.

The ship building industry continues its upswing and in particular Saint John Shipbuilding becomes more involved with C-FER Atlantic.

6.0 STRENGTHS AND WEAKNESSES

6.1 Strengths of C-FER Atlantic

a) Staff person has oil and gas industry experience, technical ability to perform research in the areas of welding, fracture, equipment design.

b) Full time office operation.

c) Commitment of TUNS to provide research facilities and manpower.

d) In touch with industry needs.

6.2 Weaknesses

a) Lack of knowledge of C-FER in the broader industrial community, i.e., pulp and paper, mining, aerospace, smaller manufacturing firms.
b) Needs Provincial Government support.
c) TUNS needs additional testing and support equipment.

7.0 STRATEGIES

7.1 Market in the Maritimes

a) Ship building and aerospace are the major industry benefactors.
b) There is an increase in the export market share for the manufacturing sector.
c) Higher level technologies are requried by a wide variety of industries.

7.2 Research Interests

Corrosion research.
Higher productivity and more advanced welding.
Mechanical property testing facilities are required.

7.3 Level of Potential Commitment

a) Saint John Shipbuilding willing to commit to project work but questions membership.
b) Small memberships possible from several small manufacturing companies (M & M, CNC, Woodside Fabricators)

7.4 Support Sources

a) Provincial Government
b) NSERC

c) Saint John Shipbuilding through project work

d) M & M Manufacturing through project and membership

e) Hanson Materials through project work and continued membership